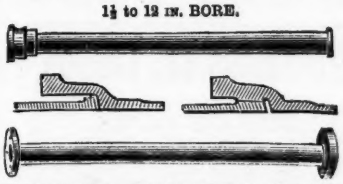
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVIII. No. 1476.] LONDON, AUGUST 25, 1891. [43RD YEAR. Price 6d.

GAS AND WATER PIPES.

1½ to 12 IN. BORE.



THOMAS ALLAN & SONS,

Bon Lea Foundry,

SOUTH STOCKTON-ON-TEES.

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Portland Cement

MANUFACTURED BY

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Capable of withstanding Greater Heat than that adequate to the Fusion of Iron.

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PURIMACHOS is regularly and increasingly used in GAS-WORKS at home and abroad, and has received the special commendation of the most distinguished Engineers and Managers, as invaluable for promptly and economically building, glazing, repairing, and consolidating RETORTS and FURNACES (in and out of action), PIPES, and ALL OTHER ERECTIONS (of Clay, Brick, or Iron) where FIRE or HEAT is employed—the action of which it will effectually resist.

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Makers of the most perfect form of Apparatus for the Manufacture of Sulphate, Muriate, Liquid Ammonia, and Tar Products.

Apparatus already erected have proved more economical in consumption of Fuel, Simplicity, and Cheapness of Working than any known Plant.

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for recovering Sulphur from Waste Gases containing Sulphuretted Hydrogen.

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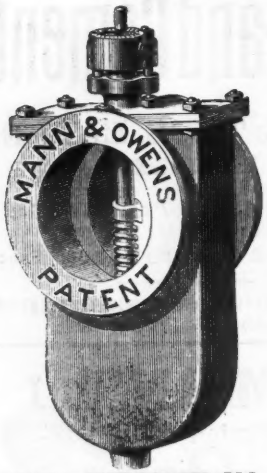
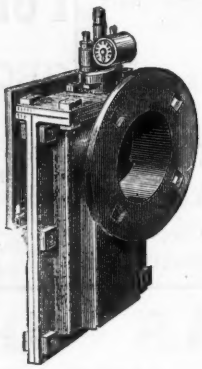
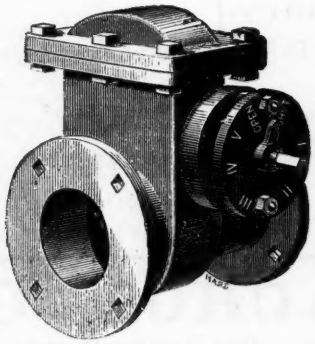


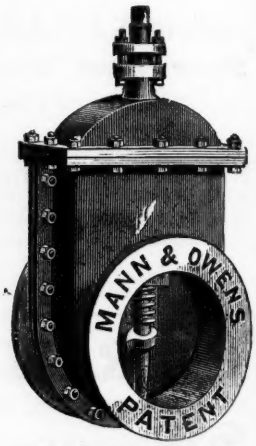
VALVE to OPEN DOWNWARDS.



BRIDGE VALVE
for Regulating the Seal
of Hydraulic Mains.



FULL-WAY RACK AND
PINION VALVE.



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MANUFACTURERS OF

SLIDE VALVES,
WITH RACK & PINION,
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of every description.
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WROUGHT AND CAST IRON
CONDENSERS,
SCRUBBERS, & WASHERS,
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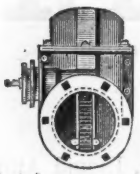
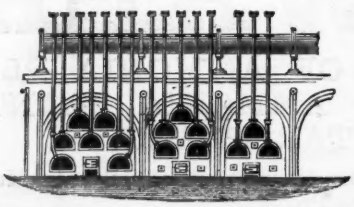
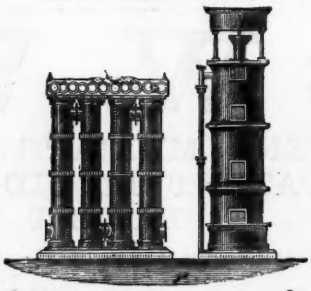
PATENT
CENTRE VALVES
for working Purifiers.
Also Bye-Pass & Stop Valves.







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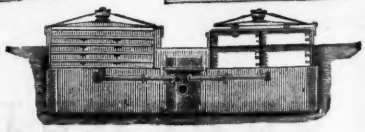

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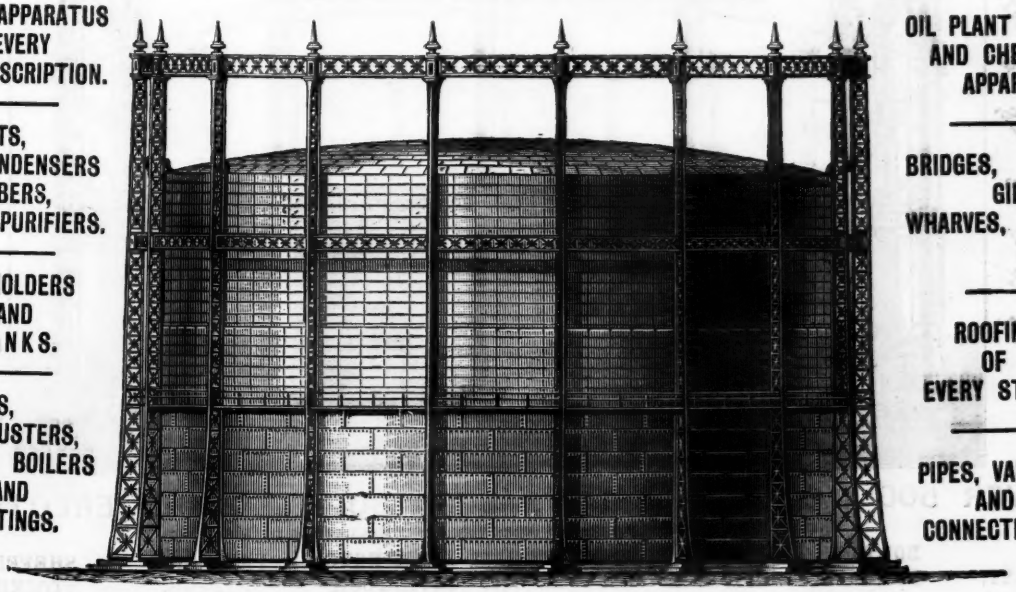

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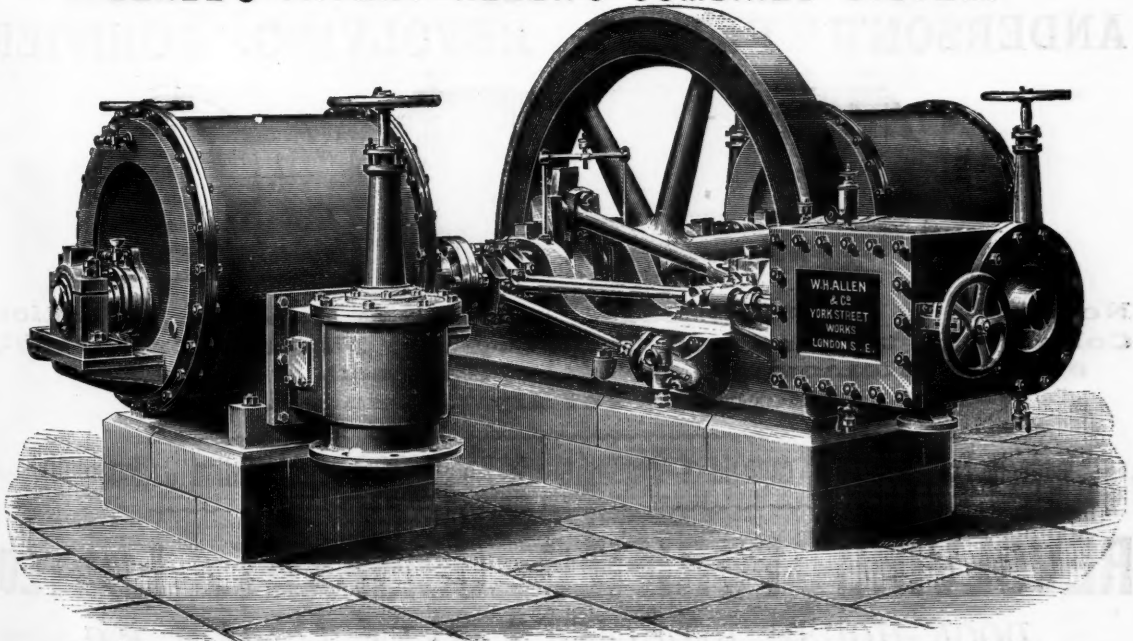

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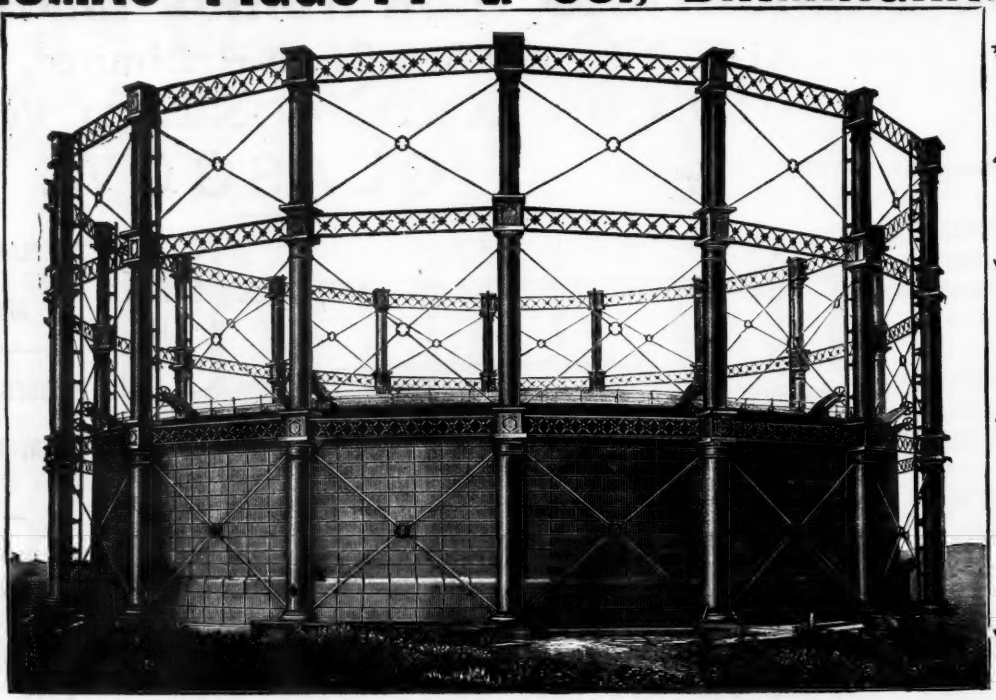

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WELDED & RIVETED FOUL PIPES, MAINS, RETORT LIDS, & CAST TANKS, PURIFIERS.

OVER 500 GASHOLDERS HAVE BEEN SUPPLIED AND ERECTED,

INCLUDING THOSE SUPPLIED TO THE FOLLOWING GAS COMPANIES AND CORPORATIONS:

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BECKTON.	BRADFORD.	CARDIFF.	LEEDS.	NOTTINGHAM.	RIO GRANDE.	SYDNEY.
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WATER PURIFICATION.

RIVER WATER and SEWAGE EFFLUENT successfully and economically treated in large volumes, by AGITATION WITH METALLIC IRON in

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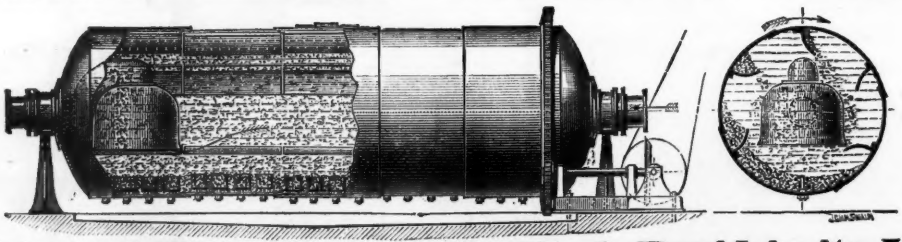

No Choking of Filter-Beds.
Colour due to Peat and Clay entirely Removed.
Simple & Rapid in its Action.
Organic Matter Considerably Reduced.
Microbes Totally Removed.

Made in Fourteen Sizes, capable of treating singly from **4000** to **1¼** Million Gallons daily.

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RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

ESTABLISHED MORE THAN A QUARTER OF A CENTURY

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GAS PLANT OF EVERY DESCRIPTION.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

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GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.

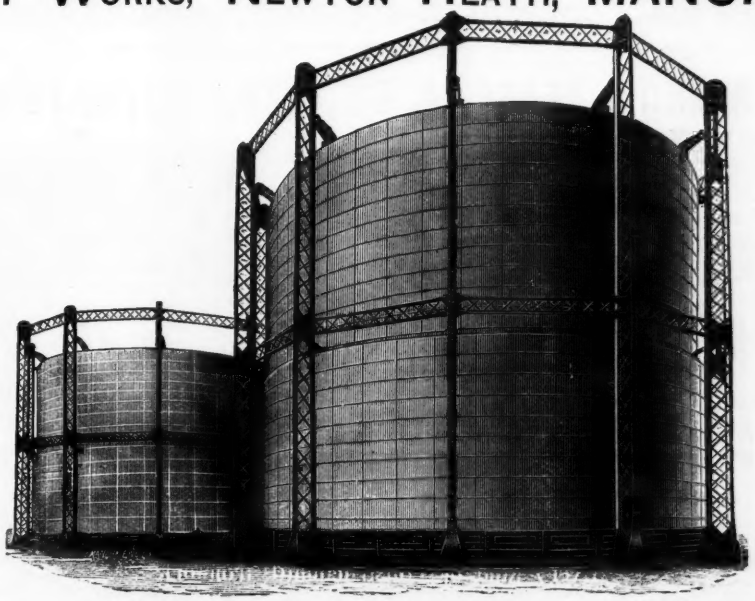

Illustration showing view of two Telescope Gasholders, each 65 feet diameter by 48 feet high, recently erected by Messrs. R. and J. Dempster, in Tanks previously occupied by Single-lift Holders 20 feet deep. The Tanks were made 4 feet deeper, by adding a Tier of Cast-Iron Plates, prepared with suitable Flanges, to meet the Brickwork of a Brick and Puddle Tank. The storeage capacity was thus increased nearly 150 per cent. at comparatively little outlay.

The best Stove made for Hiring out purposes. Can be taken to pieces readily.

Richmond's Cast-Iron and Enamel "Model" Gas Range.

UNSWORTH & RICHMOND, LTD.,

GAS APPARATUS MANUFACTURERS,

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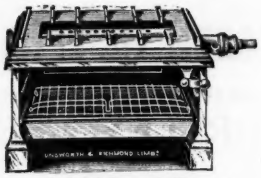
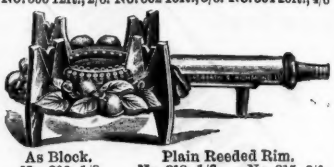


Quick Lever Grill.
No. 200 10×9×7½, 7/-. No. 205 12½×11×8, 10/-

GREAT SUCCESS of RICHMOND'S MODEL GAS RANGE. Beat Six well-known Makers. Nelson, June 2, 1891.

Burners suitable for heavy work.
No. 300 12ft., 2/6. No. 302 16ft., 3/6. No. 304 20ft., 4/6



As Block. Plain Reeded Rim.
No. 306, 1/8. No. 313, 1/6. No. 315, 3/6.
No. 308, 2/6. No. 314, 2/6.

Hot Plate Burners, all loose for cleaning. Jet and Cock combined. Best Stove Extant. Repeat Orders Daily. Try it!

G. J. EVESON,

GAS COAL AND CANNEL CONTRACTOR,

PATENTEE OF

A SPECIAL COMPOUND

FOR THE CURE OF STOPPED ASCENSION-PIPES,

A couple of charges of which will clear a stopped pipe, and an occasional charge keeps them clean, and also increases the make per ton and the illuminating power.

PRICE AND PARTICULARS ON APPLICATION.

Head Office: CORPORATION STREET, BIRMINGHAM.

ASHMORE, BENSON, PEASE, & CO., LTD., STOCKTON-ON-TEES.

TELEGRAMS
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SIMPLE IN CONSTRUCTION EFFECTIVE IN RESULTS
MAKERS OF LARGEST GAS HOLDER IN THE WORLD
ASHMORE BENSON PEASE & Co
STOCKTON -ON-TEES
SULPHATE PLANT
DAVIS PATENT
ECONOMICAL IN COST & SPACE
STILLS IN STOCK 2 3 & 4 FT DIA
MAKERS OF
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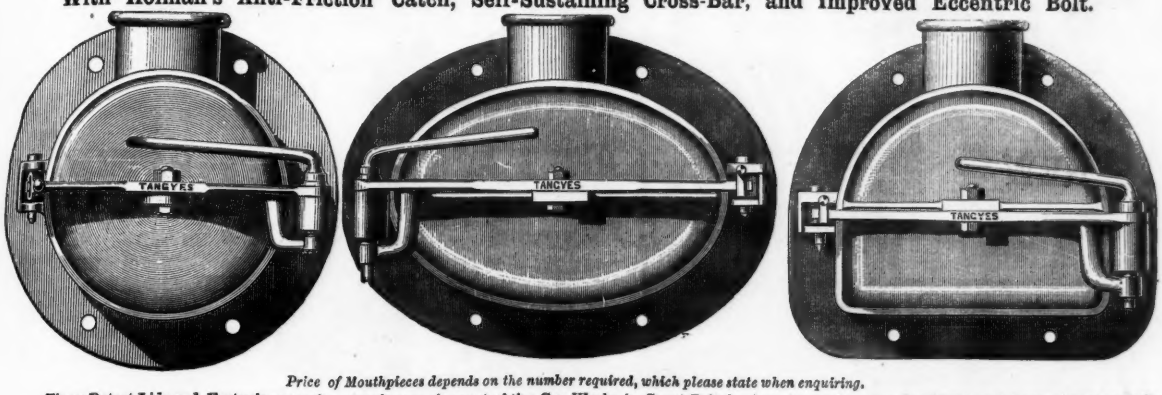
MORTON'S SELF-SEALING RETORT-LID

With Holman's Anti-Friction Catch, Self-Sustaining Cross-Bar, and Improved Eccentric Bolt.



Price of Mouthpieces depends on the number required, which please state when enquiring.

These Retort Lids and Fastenings are in extensive use in most of the Gas-Works in Great Britain, America, and on the Continent, and have almost entirely displaced the older method of sealing by a luting of lime or other material. The Lids are made in three forms, round, oval, and D (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these lids are recommended to make their selection, in order to avoid cost of pattern making, delays, &c., &c.

Mouthpieces with Circular Lids for Round Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
3494	14 ins.	14 ins.	12½ ins.	£0 19 0
2982	15 ,,	15 ,,	14 ,,	1 0 0
3453	15 ,,	15 ,,	12½ ,,	1 0 0
3497	15 ,,	15 ,,	15 ,,	1 0 0
3630	16 ,,	16 ,,	10½ or 11⅝ ,,	1 1 0
4549	16 ,,	16 ,,	15½ ,,	1 1 0
6262	16 ,,	16 ,,	13½ ,,	1 1 0
6396	16 ,,	16 ,,	16 ,,	1 1 0
7668	16 ,,	16 ,,	17⅝ ,,	1 1 0
10289	16 ,,	16 ,,	11 ,,	1 1 0
3356	17 ,,	17 ,,	15 ,,	1 3 0
7125	17 ,,	17 ,,	6 ,,	1 3 0
933	18 ,,	18 ,,	11⅜ ,,	1 5 0
4045	18 ,,	18 ,,	14 ,,	1 5 0
6397	18 ,,	18 ,,	15 ,,	1 5 0
8013	18 ,,	18 ,,	15 ,,	1 5 0

Taper Circular Mouthpieces with Circular Lids for Round Retorts.

Pattern No.	Front.	Back.			
13001	15 to 21 ins.		21 ins. diam.	13½ ins.	£1 0 0
13261	15 ,, 24 ,,		15 ,,	13⅝ ,,	1 0 0
12995	15 ,, 30 ,,		30 ,,	13 ,,	1 0 0
9562	18 ,, 21 ,,		21 ,,	12½ ,,	1 5 0
10425	18 ,, 21 ,,		21 ,,	4½ ,,	1 5 0
13418	18 ,, 22 ,,		22 ,,	12 ,,	1 5 0
13396	20 ,, 20⅝ ,,		20⅝ ,,	4 ,,	1 11 0

Mouthpieces with Circular Lids for D Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
5348	14 ins.	14 × 13 ins.	7 ins.	£0 19 0
14209	14 ,,	14 ,, 13 ,,	13½ ,,	0 19 0
14231	14 ,,	12⅝ ,, 12⅝ ,,	10 ,,	0 19 0
3463	15 ,,	15 ,, 13 ,,	14 ,,	1 0 0
6678	15 ,,	15 ,, 14 ,,	12 ,,	1 0 0
3661	15½ ,,	15½ ,, 13 ,,	12 ,,	1 1 0
13052	16 ,,	16 ,, 13 ,,	18 ,,	1 1 0
5601	16 ,,	16 ,, 14 ,,	15 ,,	1 1 0
6827	16 ,,	16 ,, 14 ,,	17 ,,	1 1 0
4494	16 ,,	16 ,, 14 ,,	14 ,,	1 1 0
3548	16 ,,	16 ,, 15 ,,	12⅜ ,,	1 1 0
6677	16 ,,	16½ ,, 13½ ,,	12½ ,,	1 1 0
9645	16 ,,	16½ ,, 13⅝ ,,	12½ ,,	1 1 0
4434	16 ,,	17⅛ ,, 14 ,,	14 ,,	1 1 0
6469	16 ,,	18 ,, 14 ,,	15 ,,	1 1 0
9015	16 ,,	18 ,, 14 ,,	18⅜ ,,	1 1 0
4327	16 ,,	18 ,, 15 ,,	15½ or 19 ,,	1 1 0
8049A	16 ,,	18 ,, 15 ,,	17⅝ ,,	1 1 0
6137	16 ,,	20½ ,, 13½ ,,	13½ ,,	1 1 0
5918	17 ,,	18 ,, 14 ,,	14 or 17 ,,	1 3 0
5053	17 ,,	19⅜ ,, 12 ,,	14½ ,,	1 3 0
7548	17 ,,	20 ,, 13 ,,	15 ,,	1 3 0
6468	17 ,,	20 ,, 16 ,,	15½ ,,	1 3 0
4316B	17 ,,	21 ,, 14 ,,	14 ,,	1 3 0
7975	17 ,,	21 ,, 15 ,,	14½ ,,	1 3 0
13455	17 ,,	21½ ,, 15½ ,,	15 ,,	1 3 0
14284	18 ,,	18 ,, 13½ ,,	19 ,,	1 5 0
12990	18 ,,	18 ,, 15 ,,	15 or 19 ,,	1 5 0
7135	18 ,,	18⅜ ,, 15 ,,	13 ,,	1 5 0
10221	18 ,,	18 ,, 16 ,,	12⅜ ,,	1 5 0
4506	18 ,,	20 ,, 13 ,,	19½ ,,	1 5 0
6470	18 ,,	20 ,, 13 ,,	15 ,,	1 5 0
6818	18 ,,	20 ,, 13½ ,,	17⅜ ,,	1 5 0
13998	18 ,,	20 ,, 14 ,,	19½ ,,	1 5 0
4083	18 ,,	20 ,, 15 ,,	16 ,,	1 5 0
5306	18 ,,	20½ ,, 14 ,,	15½ ,,	1 5 0
13295	18 ,,	20½ ,, 14 ,,	19½ ,,	1 5 0
7356	18 ,,	20½ ,, 13½ ,,	13 ,,	1 5 0
4569	18 ,,	21 ,, 14 ,,	18 ,,	1 5 0
3628	18 ,,	21 ,, 15 ,,	16 ,,	1 5 0
13999	18 ,,	22 ,, 14 ,,	19½ ,,	1 5 0
7640	18 ,,	22 ,, 12½ ,,	13½ ,,	1 5 0
14250	19 ,,	19 ,, 14 ,,	19 ,,	1 8 6
14286	19 ,,	20 ,, 13½ ,,	20 ,,	1 8 6
7971A	20 ,,	20 ,, 15 ,,	18 ,,	1 11 0
14285	20 ,,	21 ,, 13½ ,,	19 ,,	1 11 0

Mouthpieces with Circular Lids for Oval Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
13658	14 ins.	14 × 12 ins.	15 ins.	£0 19 0
4356	14 ,,	18½ ,, 12 ,,	12⅜ ,,	0 19 0
6851	15 ,,	16 ,, 14 ,,	13 ,,	1 0 0
3629	15 ,,	18¼ ,, 13½ ,,	14 ,,	1 0 0
3580	15 ,,	21 ,, 15 ,,	15 ,,	1 0 0
6264	16 ,,	18½ ,, 15½ ,,	15¾ ,,	1 1 0
5210	16 ,,	20 ,, 14 ,,	15 ,,	1 1 0
6263	16 ,,	24 ,, 16 ,,	13½ ,,	1 1 0
5370	17 ,,	20 ,, 14 ,,	14 ,,	1 3 0
6832	17 ,,	20 ,, 14 ,,	17 ,,	1 3 0
6183	17 ,,	20 ,, 15 ,,	15 ,,	1 3 0
4289	17 ,,	21 ,, 15 ,,	14 ,,	1 3 0
5270	17 ,,	22 ,, 14 ,,	14 ,,	1 3 0
3631	18 ,,	18 ,, 14 ,,	20 ,,	1 5 0
3681	18 ,,	21 ,, 14 ,,	13½ or 15 ,,	1 5 0
3554	18 ,,	21 ,, 15 ,,	14¾ ,,	1 5 0
7957	18 ,,	22 ,, 16 ,,	14 ,,	1 5 0
8048A	19 ,,	25½ ,, 15 ,,	18 ,,	1 8 6

Mouthpieces with Oval Lids for Oval Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
9800	18 × 14⅞ ins.	18 × 14⅞ ins.	15 ins.	£1 5 0
9205	20 ,, 12 ,,	24 ,, 14 ,,	10½ ,,	1 10 0
10000	20½ ,, 14½ ,,	20½ ,, 14½ ,,	16 ,,	1 10 0
9680	21 ,, 15 ,,	21 ,, 15 ,,	15 ,,	1 12 0
10056	21 ,, 14½ ,,	21 ,, 14½ ,,	15¾ ,,	1 12 0
13218	21 ,, 15 ,,	21 ,, 15 ,,	17 ,,	1 12 0
10514	22½ ,, 13⅜ ,,	22½ ,, 13⅜ ,,	13⅜ ,,	1 13 0
13766	20 ,, 17 ,,	20 ,, 17 ,,	15⅛ ,,	1 15 0
13269	24 ,, 15 ,,	24 ,, 15 ,,	16 ,,	1 18 0
13884	24 ,, 15 ,,	24 ,, 15 ,,	10 ,,	1 18 0

Mouthpieces with D Lids for D Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimension of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
12292	15½ × 13 ins.	15½ × 13 ins.	12 ins.	£1 2 0
9967	16 ,, 14 ,,	16 ,, 14 ,,	15½ ,,	1 3 0
13574	16⅜ ,, 13⅜ ,,	16⅜ ,, 13⅜ ,,	12½ ,,	1 4 0
9899	18 ,, 12 ,,	18 ,, 12 ,,	14 ,,	1 4 0
12980	16 ,, 16 ,,	16 ,, 16 ,,	18 ,,	1 6 0
13900	18 ,, 13⅜ ,,	18 ,, 13 ,,	15 ,,	1 6 0
9912	18 ,, 13½ ,,	18 ,, 18½ ,,	17 ,,	1 6 0
9962	18 ,, 13½ ,,	18 ,, 13½ ,,	16 ,,	1 6 0
10982	18 ,, 13½ ,,	18 ,, 14 ,,	15 ,,	1 6 0
11098	18 ,, 14 ,,	18 ,, 14 ,,	13 ,,	1 6 0
9492	20 ,, 13 ,,	20 ,, 13 ,,	15 ,,	1 10 0
9208	20 ,, 13 ,,	20 ,, 13 ,,	19½ ,,	1 10 0
10251	20 ,, 13 ,,	20 ,, 13 ,,	15½ ,,	1 10 0
12964	20 ,, 13 ,,	20 ,, 13 ,,	13½ ,,	1 10 0
9909	20 ,, 13⅜ ,,	20 ,, 13⅜ ,,	17 ,,	1 10 0
12969	19½ ,, 15½ ,,	19½ ,, 15½ ,,	14 ,,	1 11 0
13781	20 ,, 15 ,, Front. / 21 ,, 15 ,, Back.	21 ,, 15 ,,	15 ,,	1 11 0
14287	20½ ,, 14⅝ ,,	20½ ,, 4⅞ ,,	17 ,,	1 11 0
7692	21 ,, 15½ ,,	21 ,, 15½ ,,	16 ,,	1 11 0
12978	20 ,, 16 ,,	20 ,, 16 ,,	17 ,,	1 11 0
13252	20 ,, 16 ,,	20 ,, 16 ,,	18 ,,	1 11 0
13220	21 ,, 15 ,,	21 ,, 15 ,,	17 ,,	1 11 0
13992	21 ,, 16 ,,	21 ,, 16 ,,	17 ,,	1 11 0
8977	21½ ,, 13⅜ ,,	21½ ,, 13⅜ ,,	18½ ,,	1 12 0
8976	21½ ,, 13⅜ ,,	21½ ,, 13⅜ ,,	18½ ,,	1 12 0
10497	21½ ,, 13⅜ ,,	21 ,, 13½ ,,	18½ ,,	1 12 0
8037	21½ ,, 13⅜ ,,	21½ ,, 13⅜ ,,	18½ ,,	1 12 0
9908	21½ ,, 13⅜ ,,	21½ ,, 13½ ,,	15 ,,	1 12 0
10404	21½ ,, 13⅜ ,,	22 ,, 14 ,,	18½ ,,	1 12 0
12410	21½ ,, 13⅜ ,,	22 ,, 14 ,,	12 ,,	1 12 0
13822	21½ ,, 13⅜ ,,	22 ,, 14 ,,	15 ,,	1 12 0
10515	22½ ,, 12⅝ ,,	22½ ,, 12⅜ ,,	13½ ,,	1 12 0
7924	24 ,, 14 ,,	24 ,, 14 ,,	15⅜ ,,	1 13 0
13807	24 ,, 15½ ,,	24 ,, 15½ ,,	16 ,,	1 14 0
9015B	25 ,, 14 ,,	25 ,, 14 ,,	12½ ,,	1 14 0
10932	25 ,, 14 ,,	24 ,, 14 ,,	13½ ,,	1 15 0
12944B	22 ,, 16 ,,	22 ,, 16 ,,	16 ,,	1 15 0
14037	22 ,, 16 ,,	2 ,, 16 ,,	16 ,,	1 15 0
14119	22 ,, 16 ,,	22 ,, 16 ,,	18 ,,	1 15 0

Patterns marked A have Sockets at back to connect to Retorts; all the others are flanged. Patterns marked B have curved bottoms.

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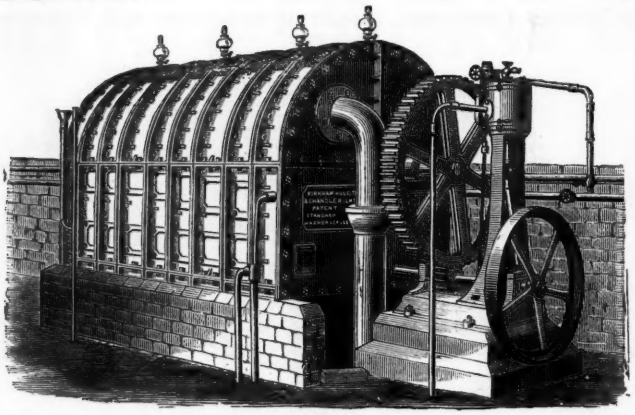
[SIDNEY HERSEY, Managing Director.] (LIMITED) [J. CHANDLER, Engineer.]



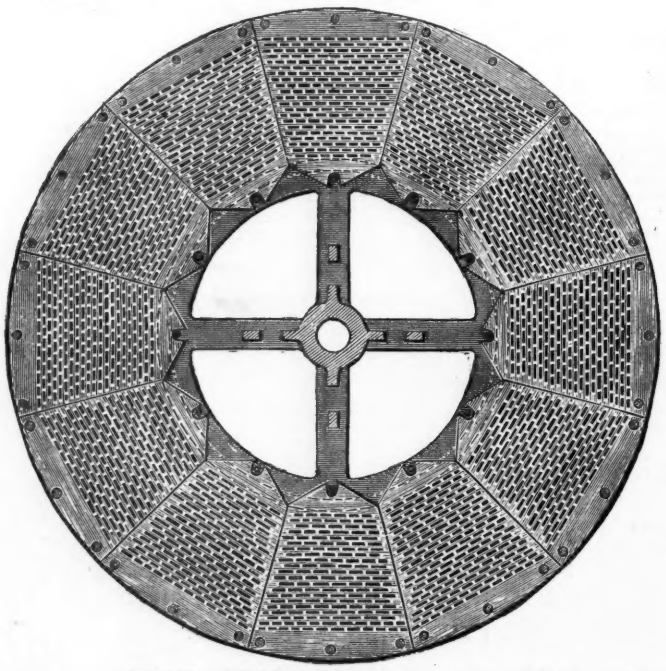
NEW PATENT

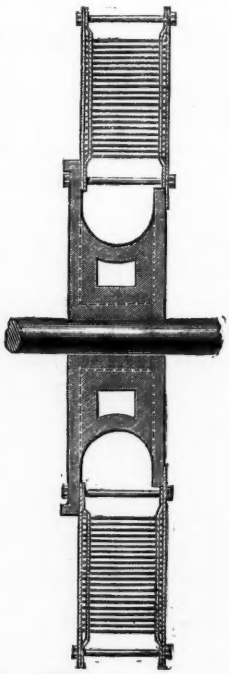
"STANDARD" WASHER-SCRUBBER.

KIRKHAM, HULETT, & CHANDLER, Limited, have pleasure in drawing the attention of Gas Engineers and others interested in the question of the extraction of ammonia and other impurities from Coal Gas to their new Patent "Standard" Washer-Scrubbers, of which 44 are at work and in course of construction.

The original "Standard" Washer-Scrubber (of which 368, equal to a daily capacity of 318,560,000 cubic feet of gas, have been supplied) was admittedly the best machine in the market for the purpose for which it was designed; and the experience gained by the Company during the past nine years has resulted in the production of an improvement on the original patent which has been applied to **23** old pattern machines, and may be briefly described as follows:—

In place of the indented iron sheets made up in segments, and technically called "Bundles," the washing surfaces are now constructed of wooden laths kept in position by being passed through slotted iron sheets, and then butting on to plain sheets, bolted together as shown.





THE ADVANTAGES OF THIS SYSTEM ARE:

(1) The Driving-Shaft of the Washer-Scrubber is relieved of five-sixths of the weight (the weight of the Wooden bundles being only one-sixth of those in Iron).
(2) The weight in motion is only one-sixth of that in the original "Standard" Washer-Scubbers.
(3) The driving power required, and "wear and tear" are enormously reduced.
(4) The washing surfaces keep perfectly clean and free from deposit from end to end of the machine.

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IMPROVED STREET LIGHTING

AND

THE AVERAGE METER SYSTEM FOR STREET LAMPS.

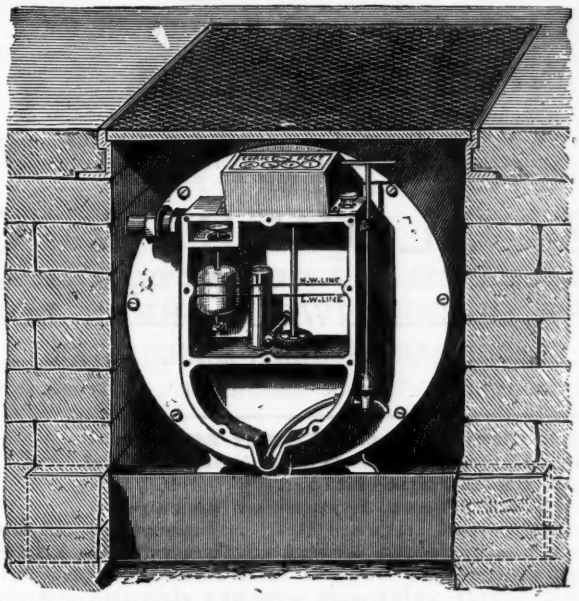
The Illustrations show the various Arrangements of Meters for these purposes. The cases are of cast iron; and the sizes are up to 20 lights for Brick Tank and Iron Box, and up to 5 lights for Pillars. Are largely used in London and Provincial Towns, giving great satisfaction. This is chiefly due to Meters being on the **WARNER & COWAN** Principle. Its advantages are:—

Correct Registration, with Variable Water Line.

Long Float Range, preventing Valve being Closed by Vibration from Traffic.

Frequent Inspection unnecessary, as Meters need only be watered at intervals of nine to twelve months.

To prevent Freezing, a little Glycerine should be mixed with Water when severe frost sets in.

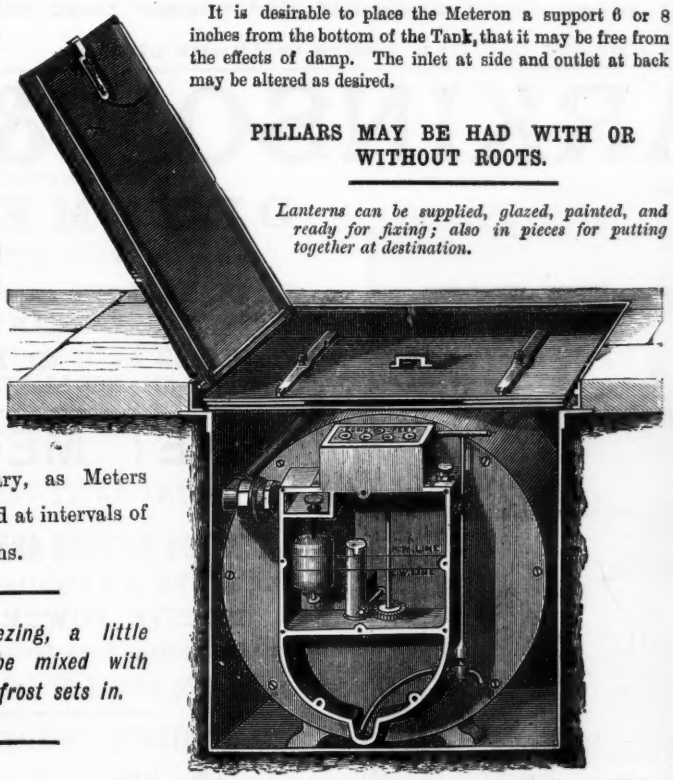


Meter in Brick Tank, with Footway Plate.

It is desirable to place the Meteron a support 6 or 8 inches from the bottom of the Tank, that it may be free from the effects of damp. The inlet at side and outlet at back may be altered as desired.

PILLARS MAY BE HAD WITH OR WITHOUT ROOTS.

Lanterns can be supplied, glazed, painted, and ready for fixing; also in pieces for putting together at destination.



Meter in Water-tight Cast-Iron Box, with Footway Plate.

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LONDON, MANCHESTER,

AND

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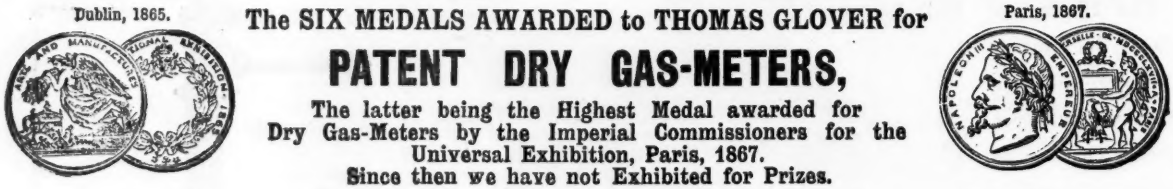
Dublin, 1865. Paris, 1867.



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Since then we have not Exhibited for Prizes.

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And at 37, BLACKFRIARS STREET, MANCHESTER.

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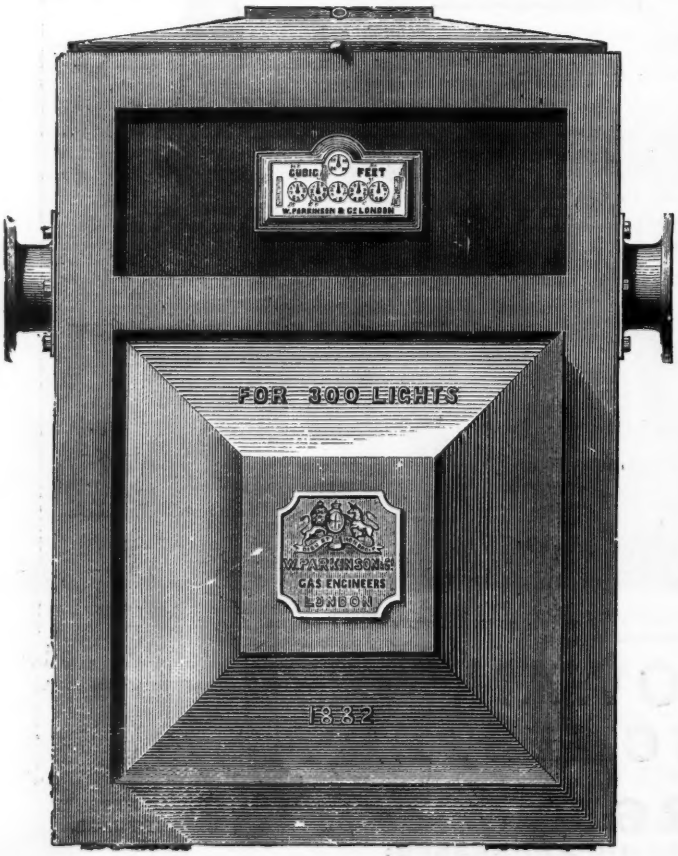
2nd—Are suitable for all climates, whether hot or cold.
3rd—Incur no loss of Gas by Evaporation.
4th—Cannot become fixed by Frost, however severe.
5th—Are the most accurate and unvarying measurers of Gas.
6th—Prevent jumping or unexpected extinction of the Lights.
7th—May be fixed either above or below the level of the Lights.
8th—Cannot be tampered with without visibly damaging the outer case.
9th—Will last much longer than Wet Meters.
10th—Will not cost more than one-half for repair that Wet or Water Meters do.

Are upheld for five years without charge.

W. PARKINSON & Co.



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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

TO ADVERTISERS.

ADVERTISEMENTS for the next number of the JOURNAL must be received by Monday, 12 o'clock noon, to ensure insertion; but **Orders for Alterations in or Stoppages of PERMANENT ADVERTISEMENTS should be received Not Later than the FIRST POST on SATURDAY.**

THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, AUGUST 25, 1891.

The South Metropolitan Meeting.

THE South Metropolitan meeting on Wednesday last, which will be found fully reported in the usual place, was one of the most interesting that has been held even by this renowned corporation. The circumstances were very favourable to such a result; for it is not often that a Board of Directors of a Gas Company find themselves compelled, by force of figures, to take up an attitude of defence. A well-known Chairman of Railway Companies recently apologized to a meeting of a Company of another kind, to whose proprietors he had to recommend the declaration of a substantial dividend, for any awkwardness which might appear in his transaction of such an unwonted proceeding. He said that the declaration of a dividend was such a novelty in his extensive experience of company management, that he felt quite at a loss what to talk about in the circumstances. The condition is exactly reversed in respect of gas company management. Fat and secure dividends are apt to render the most restless of chairmen listless in speech, if not perfunctory in conduct; and there have been certain years when the Chairman of the South Metropolitan Gas Company has appeared to feel the want of excitement at home, and has looked afield for dragons to slay. All this has been changed, however; and to-day, as for a year or two past, there is quite enough in the business of South Metropolitan gas supply to occupy the full powers of any ordinary administrator. Mr. George Livesey, it is true, is no ordinary administrator, and even in these times he has found it possible to undertake, in addition to his other employments, the responsibility of helping to advise the Government upon the Labour Question. Last Wednesday, however, those who might have wished to see and hear the Chairman of the South Metropolitan Gas Company in his favourite *rôle*, and at his best, had a good opportunity for gratifying themselves. Mr. Livesey's address, confessing to the hardness of the times through which the Company have been passing during the last two years, and admitting the necessity of raising the price of gas over the district, was one of the best he has ever delivered under any circumstances. Not only did he carry his audience with him—the speaker's personal magnetism never fails to exert this effect—but the matter of the address was so statesmanlike, and its style so incisive, that all the London newspapers reported it with exceptional fulness. The speech was in the Chairman's best manner; and after this there is no more to be said in its praise.

The matters dealt with by Mr. Livesey were various, but related principally to the subject of the price of coal the testing of gas, and the question of labour. The statement of the method by which the coal supply of the South Metropolitan Company has always been obtained at a low figure in comparison with the prices paid by some Companies, is a memorable one. Like all great discoveries, this method is extremely simple. It consists in making short contracts, and in refraining from all artful attempts to get the better of contractors. In addition, we may observe that the South Metropolitan coal purchases are never entered into under the influence of panic; and the coal bought is such as the Engineers responsible for making the gas approve, and can make good use of. Upon the subject of the official gas testings, Mr. Livesey passed some exceedingly stringent criticisms; and it did not need much perception to divine that if the speaker had been free to utter all that was in his mind upon this matter, the London County Council would have been vividly enlightened with regard to the practical working of the system of gas testing, which costs the public so substantial a sum yearly. The remarks upon the advantages of a strong reserve fund for Gas Companies were very much to the purpose; and might have been made still more pointed, if the speaker had so desired, by reference to the contemporary examples of some corporation gas undertakings, where the absence of any such provision for adjusting revenue accounts is productive of incessant fluctuations in the price of gas, to say nothing of other inconvenient results. With regard to the relations existing between the Company and their men, Mr. Livesey had nothing but the most reassuring accounts to give. His observations on this head were couched in language that may give offence in some quarters, where high wages are systematically upheld as the greatest earthly good for the worker. Seeing that the South Metropolitan scale of wages is as high as any, the Chairman doubtless felt himself free to speak his mind with regard to the ultimate benefits derived from high pay and short hours. An entertaining reference to the condition of the South Metropolitan workmen, as revealed to an outsider at the "garden party" given to the men by the Directors last Saturday week, was contributed to the proceedings of the meeting by a shareholder, and formed a fitting commentary upon Mr. Livesey's utterances on the general subject. With a few luminous remarks on the newly-adopted policy

of the Board in regard to offering fresh capital for subscription in small amounts by consumers and workmen, the Chairman's address came to an end amid hearty applause from a thoroughly sympathetic meeting.

The British Association Meeting.

THE British Association for the Advancement of Science met at Cardiff on Wednesday last, under the presidency of Dr. W. Huggins, F.R.S., who succeeds Sir F. Abel in the chair, and will be followed in turn by Sir Robert Ball, the Astronomer-Royal for Ireland. The usual notables attended the opening ceremonies. Professor Rücker succeeds Dr. Williamson in the office of General Treasurer; regret being expressed by the Council that Dr. Williamson, who has served the Association in this honourable and responsible capacity for seventeen years, has been unable to attend the meeting, and could not allow himself to be again nominated to the office he has held so long and with such advantage to the Association. The address of the President, as might be expected of the pioneer in the application of the spectroscope to the examination of the celestial bodies, was wholly devoted to astronomical subjects. Yet, remembering how much modern astronomy has benefited from the labours of Dr. Huggins himself, it is instructive to note how infrequent is the "personal "pronoun, first person singular," in his most interesting address. Your petty inventor can hardly open his mouth without clamouring for recognition as the only true and original discoverer of this or that device; but Dr. Huggins can talk of spectroscopy and its results as dispassionately as an outsider, yet with the special knowledge of a master. Spectroscopy is a branch of science which one cannot help thinking ought to be very much more interesting to a gas engineer than is actually the case. When the spectroscope was first devised, and experimentally used in physics, hopes were entertained that it would prove useful in the investigation of gaseous flames, in photometry, and otherwise for purposes cognate to gas manufacture. These hopes have failed. Spectroscopy is useful in the manufacture of steel and in sugar refineries; but it has absolutely no place in the study of commercial gases. Yet, with due regard to this circumstance, and to the additional fact that Dr. Huggins's address dealt mainly with astronomical subjects, this oration will be found studded with observations of interest to all who intelligently follow the industry of artificial lighting. The terms photometry, radiation, brightness, flame-temperature, and so forth, are employed very differently by a philosopher like Huggins, from the manner in which they are used by technicians; and in this very difference there is instruction. Whatever else may or may not be done at this British Association meeting, the presidential address is to be ranked as a distinct gain to science from the occasion.

A Rash Experiment for Cork.

THE Directors of the Cork Gas Consumers' Company have decided, with the concurrence of the shareholders, to apply to the Board of Trade for an Electric Lighting Order. A further meeting of the Company is to be convened before anything definite is done in the matter; but the Board have put themselves into communication with the Corporation in regard to the subject, in order that the next session may not be lost in case it should be determined to go on with the scheme. It will not be very far wrong to suppose, however, that, unless something untoward happens to greatly interfere with their plans, the Directors of the Cork Gas Company mean to do all that is necessary in order to occupy the unique position of being a statutory Gas Company and at the same time a statutory Electric Lighting Company. In stating their intention in their report, the Directors support their policy by reference to Continental and American example; but they are naturally unable to adduce any instance to the same end in the records of the British gas industry. It may be supposed that they and their advisers are not blind to the meaning of this remarkable difference between British and Foreign gas companies' practice. We take it that the apology of the Cork Gas Directors for essaying a line of business which all their compeers have religiously left alone, is expressed in what was advanced to this effect in the report and at the meeting—to wit, "that some of "the shareholders had asked for it; that the Company, "having already a certain establishment in Cork, could "supply the citizens with electricity cheaper than a special "company; and that by distributing electricity by means "of gas-engines they could obtain profit in two ways." These reasons are not without plausibility, especially the last; but we are constrained to observe that we do not like the scheme, and shall be immensely surprised if it is ever carried out, or, being attempted, works well for the Company. As we have often argued in another part of the JOURNAL, we are particularly curious to see the experiment of electric distribution by means of gas-engines tried in some suitable place; but, in our judgment, this would not be in Cork, nor would a statutory Gas Company be the proper undertakers of such an experiment. Why, if so many of the gas shareholders of Cork want electric lighting, do they not form an independent Company for the purpose? The Gas Company might, of course, give them facilities of various kinds for the use of gas-engines in generating their supply; but there the complicity of the Gas Company in the speculation should stop. On their own confession, the Gas Directors do not expect to make anything by their proposed venture. They cannot even pretend that Cork is a particularly favourable scene for operations of this nature; and therefore why they want to embark in anything of the kind passes comprehension. They cite foreign examples; but they must know that foreign gas companies can do what they like with their capital, which is not the case with any British statutory company. Not one per cent. of these adventurous concerns make money by their electric lighting department. In Cork, the Gas Company, even if the Board of Trade grant an Order, which the authorities will be very loth to do, will have to raise fresh capital to work it; and this could quite as well be done by a separate company. Altogether, this project of the Cork Gas Directors appears to us ill advised. They had far better stick to their own business, and let those who like it lose money over electric lighting.

A New "Salford Scandal."

ALTHOUGH the duty is a painful one, we cannot abstain from mentioning the last "Salford Gas Scandal," which will be found reported elsewhere. Mr. Sydney Kershaw, who has been one of the contractors for the supply of gas coal to the Corporation, has been committed for trial from the Borough Police Court, on the charge of offering to bribe Mr. S. Y. Shoubridge, the Gas Engineer of the Corporation, in respect of the discharge of his duty. The charge was preferred under the new Public Bodies Corrupt Practices Act, 1889, which was practically the outcome of the old Salford scandal; and we believe it is the first-fruit of this measure. The circumstances of the charge and the nature of the evidence will be found in our report. We must be excused from paraphrasing them here. Let it suffice, by way of commentary upon these proceedings, to offer our condolences to Mr. Shoubridge upon the extremely painful circumstances which have led to his appearance as the *corpus vile* upon whom the efficiency of the new law is to be demonstrated. Mr. Shoubridge has acted in this matter in the only way possible to a gentleman of honour who happens to hold the position of Gas Engineer at Salford. Under some conditions, such an insult as that which is alleged to have been offered to him might have been fittingly avenged on the spot by a threat to have the offender kicked out of the office; but in Salford this line of conduct, which very many gas managers have had to follow, would not have sufficed. Whatever may be the outcome of this affair, Mr. Shoubridge will have the satisfaction of knowing that he has taken the most effective way of proclaiming to the world that the old order of Salford gas administration has passed away. The Gas Committee owe it to themselves not less than to their officer, situated as he is, to support him in endeavouring to put down the evil that has made the name of the town a byword in the land.

English Manufacturers and the Chicago Exhibition.

IN another part of the present issue of the JOURNAL will be found a reproduction of the remarks of a contemporary with reference to the inadvisability of British co-operation with the American promoters of the Chicago Exhibition of 1893, at least in so far as the electric lighting industry is concerned. Gas lighting apparatus on the British model is even less likely to be represented at this show, which, from all we can learn, threatens to be "Inter-"national" only in name. There is, indeed, something incongruous in the idea of holding a nominally "Inter-"national" exhibition in a country from which all but

home products are, as far as possible, excluded by legislation. Why do the exhibition authorities want us to send to Chicago goods on view, while the national Tariff is designed to increase their cost by 50 or 100 per cent.? Is it imagined that our manufacturers, having little or no chance of selling their productions in the States, will be so kind as to send samples of these over to serve as models for the local makers to copy? Would the Americans be likely to do anything of the kind if they were in our place? So far as gas apparatus is concerned, we might possibly teach our American cousins something; for unlimited competition has brought our manufacturers a clearer perception of the realities of things than a trader protected from the consequences of his own mistakes, among other things, can enjoy. There is the matter of consumers' meters, for example, and other domestic gas apparatus into the construction of which tinplate enters largely. The American Protectionist Press admits that M'Kinleyism is to be gauged for success or failure more particularly with regard to the tinman's trade than in connection with any other. How do our American friends get on about their meters? We should much like an authoritative answer to this question from both sides of the water. There is small probability of an English-made gas-meter being seen at Chicago the year after next, unless it is in the form of a fossil extracted from the stores of some American Gas Company which started in business before Protection reduced the English meter to a name in the States.

WATER AND SANITARY AFFAIRS.

A SOMEWHAT singular feature in connection with the water supply of London is presented by the operations of Mr. George Webster, of Harefield Grove, Middlesex, in extracting water from the chalk formation in the valley of the Colne. Mr. Grover, the Engineer of the Rickmansworth and Leatherhead water undertakings, when appearing before the Select Committee of last session on the Metropolitan Water Supply, was asked some questions as to the wells which had been sunk by Mr. Webster on that gentleman's estate. From Mr. Grover's replies, it would appear that certain evidence he had given on a former occasion before a Parliamentary Committee so impressed Mr. Webster, that he forthwith went and purchased some land in the valley immediately adjoining the works of the Rickmansworth Company, and proceeded to spend something like £20,000 in testing the site, with the result that he found an abundant supply of water, in accordance with the views previously enunciated by Mr. Grover. The ideas expressed by Mr. Grover before Sir M. W. Ridley's Committee were, that if the Metropolis Water Supply Bill was carried, Mr. Webster's water supply would have to be purchased; and the Rickmansworth and Leatherhead Companies would "co-operate" with him. "You want "the water," said Mr. Grover, "and we have got it." "I beg your pardon," rejoined the examining Counsel (Mr. Balfour Browne); "some of the people in that district "want to keep that water, and not to let you steal it." "Steal it!" ejaculated the witness; and he naturally observed, "that is a very hard word." No doubt this was a strong way of putting the question; but it serves to indicate a point of considerable importance. Mr. R. D. M. Littler, Q.C., Chairman of the Middlesex County Council, was a witness before Sir M. W. Ridley's Committee; and in speaking of the increasing population on the borders of the Metropolis, said: "In some parts of the county it will "be a serious matter for consideration how the water is "to be provided, especially if attacks such as Mr. Webster "is making upon the water supply of the district are "made." Mr. Littler went on to describe how Mr. Webster was proposing to sell to the London Companies a daily supply of 10 million gallons of water, "which," said Mr. Littler "does not belong to him." But, then, neither did the water belong to anybody else. Speaking "advisedly," Mr. Littler went on to say there was no property in water; it was "a sort of *feræ naturæ*." There was the decision in the case of *Chasemore v. Richards* to support Mr. Webster; and the law was on his side.

Further prominence has recently been given to Mr. Webster's project by the circumstance that a party of gentlemen, including several members of the Hygienic Congress, paid a visit of inspection to the Colne Valley works a few days ago; Mr. Webster having given an invitation for the purpose. There was sufficient proof that water abounded, and that Mr. Webster had got hold of it. A report on the wells by Mr. Claud Monckton, C.E., sets forth certain conclusions, to the following effect: The present wells are equal to producing 10 million gallons of pure spring water per twenty-four hours; and this can probably be increased to 20 millions. There is a reservoir 340 feet above Ordnance datum, holding 5 million gallons. Easements have been obtained into London, and up to the area of the Grand Junction Water Company. In the next place, Mr. Monckton reports to Mr. Webster: "You "are in a position to sell or lease your water and rights to "anyone who may desire to acquire the same." So far it would appear that Mr. Webster has stepped in between certain of the London Water Companies and a valuable source of water supply. Or it may be said that in this daily volume of 10 or 20 million gallons there is the capability of setting up, in some portion of the Metropolis, a competing supply. But the case is not quite so clear after all. If Mr. Webster may take the water, so may somebody else. There may come a battle in which mine and counter-mine will play a part. There is, however, a bright side to the picture. It would have been specially unfortunate if Mr. Webster's explorations had proved a failure. He has given practical demonstration to the existence of large stores of water in the chalk; and there is no reason why these should not be drawn upon for the benefit of the Metropolis, providing the district which yields the supply receives a proper share of it. The incident now before us affords an additional illustration of the folly committed some few years ago by the House of Commons, when the Bill of the Grand Junction Company for the purpose of drawing a subterranean supply from the chalk near Dorney, was thrown out without a particle of investigation. That which Parliament professed to dread, as a scheme that would impoverish the river, is now compassed by a private individual. We cannot suppose that matters will rest as they are. Neither is there any necessary hostility between Mr. Webster and the Water Companies. He has done what he was perfectly at liberty to do, but which ought to have been committed to other hands. From one point of view, the present situation is little else than ridiculous. It will also be remembered that Sir M. W. Ridley's Committee cut off the Rickmansworth and Leatherhead Companies from the scheme propounded in the Water Bill promoted by the London Vestries; the Bill afterwards going the same road.

The Boring for Coal in Kent.—Encouraged by the results of the experiments which have already been made with the trial boring for coal at the Channel Tunnel works at Dover, the promoters have determined to go to a greater depth; and to enable this to be done, the machinery is now undergoing alterations and extensions. When these are completed, the work will proceed more rapidly. The advance is only about a foot a day, owing to the length of time occupied in drawing the rods from their great depth.

The Electric Lighting of the Grand' Place in Brussels.—An ingenious suggestion has been made to the Brussels authorities with regard to the electric lighting of their principal streets, and particularly of the Grand' Place, in which the Hôtel de Ville is situated. It has hitherto been objected to the plans for the electrical illumination of this square, that the poles on which the lights were hung, and all proposed improvements in the lamps, were out of harmony with the surrounding architecture, which is of an exceedingly interesting character (many of the buildings being in the old style), and were apt to be an eyesore in the daytime. It is now proposed that the light shall be shed upon the square from tall steel standards, which will be sunk in deep sheaths underground in daylight, and elevated by hydraulic pressure at dusk, when they are wanted.

The Hydraulic Power Scheme for Manchester.—In the course of an article which appeared lately in the *Manchester Examiner* on the subject of hydraulic power, reference was made to the scheme which the Corporation are about to carry out for Manchester. Our contemporary says that some months may elapse before the hydraulic supply will be available; but it is assured, on very good authority, that there will be no unnecessary delay. The details are being carefully considered; and as soon as they are matured, the work will be pushed on energetically. The pressure which it is proposed to supply will be 1000 lbs. to the square inch; so that it will be possible to do an enormous number of things with it. It will only be in the centre of the city that hydraulic power will be available. When the Ship Canal is opened, it may be desirable to provide for the dock traffic; but in the meantime the Corporation are likely to confine their attention to the districts which are mostly occupied by warehouses

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 370.)

THE past week has witnessed a decided improvement in the state of the Stock Markets. Business has been better, and more extensive. Something like an approaching restoration of confidence is manifesting itself; and a more enterprising disposition is the accompaniment. The chief advance comes from America, where, owing to the movements in wheat, there is a considerable rise in rails. At home, notwithstanding the unfavourable weather for harvest prospects, lines in general are better. The Foreign markets also developed a brighter tendency; so that there has been a general improvement pretty well all round. The Money Market continues much the same; and though there may perhaps come a fairly strong demand for gold for America, there is no reason to expect dearer money in the immediate future. The Gas Market has been rather inactive; and prices on the whole have not advanced. Gaslight "A" opened at 237 on Monday, and was marked at 238 the next day; but it fell away later in the week, and the last bargain was at 234—the quotation falling one point. None of the debenture or preference issues were touched; but a fair amount of business at moderate figures was done in "H" 7 per cent. maximum. In South Metropolitans, a few transactions were marked in "A" and "B" at about average prices. "B" is 2½ lower, which brings it nearer to, but not yet level with, the other two issues. The debentnre stock was in good demand, and realized advanced prices. Commercials were quiet, and unchanged. Nothing at all was done in Suburbans and Provincials; and all quotations remained without variation. The Continental Companies have attracted little attention; but good prices were realized in the course of the week. South American undertakings have been quite without any special feature. Of the rest, Bombay was the most active; and it improved ¼. Sydney debentures also have advanced 1. The Water Companies have evinced more activity; and though at one time some issues were disposed to fall away, changes in quotation are all for the better.

The daily operations were: Very quiet business in Gas on Monday; but the few bargains marked were at good prices throughout, except in South Metropolitan "B," the quotation of which fell 2½. Business was better on Tuesday. Gaslight "A" was firm and active, and Bombay fetched good prices; but quotations did not move. Water was disposed to be weak. There was a fair amount doing in the Metropolitan stocks on Wednesday. South Metropolitan debenture was strong, at a rise of 1; and Bombay advanced ¼. Other figures were not remarkable. Water continued rather low. Thursday's transactions indicated that prices were not disposed to improve; but Sydney debentures were quoted 1 higher. Business in Gas on Friday presented nothing to call for special remark; being moderate and at moderate prices. Water was more active and higher. Kent rose 2½; and Lambeth and West Middlesex, 1 each. Saturday was as quiet as usual, and prices were not good; but quotations remained unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Electric Lighting of London, according to "The Times"—The Question of Street Lighting—The Financial Aspects of Electrical Traction—English Electricians will not Exhibit at Chicago.

THE remark is often made that the newspapers are always much more generally interesting during what is called the dead season, when the parliamentary mill is silent, than when they are choked with the verbiage of politics. Now is the time when matters relating to the home life of the people receive fair treatment at the hands of our popular educators; and a mass of entertaining as well as instructive matter sees the light, after having been "held over" to make room for those party debates in which we are all conventionally supposed to take an absorbing interest. During last week *The Times* published a specially-contributed article on the growth of the electric lighting industry in London, with editorial comments, well worthy of the attention of students of this subject. The writer of the article sets himself to inquire what has been the result, so far, of the relaxation in 1886 of the stringent purchase terms of the Electric Lighting Act of 1882, which a host of electricians alleged to be the sole hindrance to the commercial development of electric lighting. At the time referred to, the only central station electric lighting plant in London is stated to have been the unauthorized Grosvenor Gallery undertaking of Sir Coutts Lindsay. We do not accept this statement as representing the whole truth. Sir Coutts Lindsay's experiment undoubtedly was in existence at that time; and it was probably the most considerable speculation of the kind in London. It was not the only one, however, for at the back of Lincoln's Inn Fields, at Brixton, and possibly in more than one other Metropolitan district, it was possible for those who desired it to hire electric lamps from speculative firms. Sir Coutts Lindsay's scheme survived and blossomed into the London Electric Supply Corporation, mainly because there was plenty of money behind it. The others died from want of this necessary of life, which their promoters never had in sufficient quantity, and which they were powerless to create.

The writer in *The Times* goes on to state that since 1888 not less than leven electricity supply companies have been floated in London alone, with an aggregate capital of upwards of £3,000,000. Instead of the supply station already referred to, there are now sixteen; and the 6000 lamps of 1186 have grown to 240,000. The current is generated in these stations by steam-engines developing more than 20,000 indicated horse power; and 240 miles of conductors have been laid in the streets. It is acknowledged that the work has been done well, and that Mr. Chamberlain's much-abused Act has not hindered electric lighting in the long run. The writer calls the Act of 1882 a "blessing in disguise." Yet it was only the other day that Lord Rayleigh was caught repeating all the parrot-cries against the Act with which the speculative electricians of the time sought to cover their own recklessness and folly. The article is a very excellent one; being both well informed and well written—a not very usual combination. The editorial comment on it is also much to the point. Upon the topic of the electric lighting of the city, it is asked "whether the effective candle power supplied by the 26 arc lamps in Queen Victoria Street could or could not be supplied at the same cost by means of gas, and quite as efficiently distributed." To this query we undertake to reply not merely with a bare affirmation, but with the assertion that the work could be done by gas more effectively, and at a cheaper rate. Upon the prospect before the existing companies with regard to dividends, *The Times* is significantly reticent.

There has been a considerable amount of head-shaking in the City over the prospects of electrical locomotion, as exemplified by the working of the City and South London Railway. The undertaking is, of course, young, and nobody is likely to ignore this consideration. But, after all is said, the working of the undertaking leaves much to be desired. Its earning capacity seems to be deplorably limited; and the working expenses are phenomenally high in comparison with the standard of ordinary railways. Those expenses are at present 78 per cent. on the receipts; and they will need to be reduced to the usual 50 per cent., or thereabouts, before the line can be fairly described as working on the same level as other railways. The net profit will have to be quintupled in order to pay 5 per cent. upon the capital already expended upon the undertaking; and how this is to be done is a puzzle which the Board, who are paid for the work, must be left to solve. The experiment is a highly interesting one, and we wish it success; but it seems to share the disability of electric lighting schemes in being both technically perfect and commercially halting. Electrical machinery and apparatus, we are assured by those who are best qualified to judge, is practically unimproveable. With dynamos warranted to give a duty of 95 per cent., and other machinery almost equally good, the boast must be admitted to be well founded. Yet, for reasons which transpire from time to time, there is no parity between the technical and commercial balance-sheets of these concerns.

In a vigorous article, our contemporary the *Electrician* expresses its strong conviction that, while it may pay English electricians to visit the Chicago Exhibition of the year after next, in order to see collected together "the many strange things in electricity that America has brought forth during the past ten years," it will be better for them to confine their participation in the big show to that of on-lookers. For this opinion there is much reason; and it will probably be shared by other English technicians and business men besides the electricians. So far as the latter are concerned, the utter absence of any market for their productions in the United States would be of itself a sufficient discouragement of the idea of sending goods to Chicago for show; and over and above this consideration, a nation that guards its manufactures with the flaming sword of M'Kinleyism, which turns every way at once, must not be surprised if other nations leave it in full possession of its own Paradise. Our electrical contemporary will not admit that American electrical practice in either lighting or traction is as good as our own; but it confesses that there is more of it. While British electricians were compelled to improve their designs in order to avoid the fate of the early speculators, a large demand for electrical machinery had already arisen in the States. Plant had to be constructed "somehow;" and, as is pertinently remarked, it was generally constructed "anyhow." Moreover, the type of electrical traction which has been evolved in America is one that seems to suit local conditions, although it is something that no English engineer would find it worth while to touch. On the whole, therefore, it is considered that inducements for sending English electrical apparatus to Chicago are singularly lacking; and this is a conclusion which rests upon too obvious and powerful commercial considerations to be disputed by Americans themselves.

Mr. Grafton's Articles on "The Standard of Light."—Our readers will see, by an advertisement which appears elsewhere, that the articles recently contributed to the JOURNAL by Mr. Walter Grafton, of The Gaslight and Coke Company, on "The Standard of Light," have been reprinted in pamphlet form.

Death of Mr. T. Cramp.—We regret to announce the decease of Mr. T. Cramp, at his residence at East Grinstead. He was one of the original promoters of the East Grinstead Gas Company, and for many years occupied the position of Secretary; but on the amalgamation with the Water Company he resigned the office and became a Director. His death took place last Tuesday evening, at the age of 82, after a short illness.

PERKIN AND HIS WORK.

THE announcement that the Albert Medal of the Society of Arts has been presented to Dr. W. H. Perkin, F.R.S., "for his discovery of the method of obtaining colouring matter from coal tar, a discovery which led to the establishment of a new and important industry, and to the utilization of large quantities of a previously worthless material," is something that ought not to be allowed to pass by this JOURNAL as though it were an ordinary piece of news. Most of the scientific and technical periodicals which have noticed the presentation have so permitted it to pass; but the incident is too reminiscent of a certain historical phase of the development of the gas industry for us to be satisfied with a bald statement of the event. Moreover, it is desirable to take this opportunity for briefly reviewing Dr. Perkin's work and its results to the gas industry, because there is reason to believe that a considerable amount of misapprehension on the latter branch of the subject exists in the public mind. We lately saw how an otherwise well-informed writer in a popular magazine made a serious blunder in his statement of the nature of the interest taken by statutory gas companies in the utilization of tar products. Referring to a Metropolitan gas company, this writer remarked that it paid the company to keep upon their works a large staff of chemists to do nothing else but investigate coal-tar products, with a view to the discovery of new preparations, the manufacture of which might return a profit to the company. And the hackneyed observation that gas companies make so much profit out of their tar and other residuals that they could afford to give away their gas and yet pay their ordinary dividends, is offered many times a year by certain of the "well-informed" persons who are selected to preside at popular lectures on chemistry, &c.

It is proper, however, to begin with a statement of Dr. Perkin's claim to fame; leaving the effects of his labours to after consideration. Speaking as President of the British Pharmaceutical Conference, which sits conjointly with the British Association, and therefore opened last week at Cardiff, Mr. W. Martindale, F.C.S., observed that "it is about 35 years since Dr. Hoffman induced Dr. Perkin to undertake a research with a view to building up quinine artificially from derivatives of coal tar. This investigation was unsuccessful, though it resulted in the discovery of mauve, and soon led to the preparation of the various brilliant colours which have dazzled our eyes during the latter parts of this century." Lunge, the principal authority upon the subject, ascribes to Perkin the production of the first aniline colour, and assigns to this discovery, for which he gives the date 1856, the results of imparting a sudden impetus to tar distilling and the conversion of coal tar "in the centres of industry, where at the same time most gas is produced," from a "nuisance into a commercial article in good demand at good prices." In the introduction to the chapter on "Tar and Tar Products" in "King's Treatise on Coal Gas," it is remarked that "when Perkin made his grand discovery" that aniline obtained from benzol could be made by a simple process to yield the most beautiful purple then known, it was evident "that coal tar would soon become of great commercial value"—which is as much as saying that it was of little value before. Indeed, the definite statement is previously made that "quite within the memory of living chemists, coal tar was considered a substance of so little worth, that its rapid accumulation in gas-works was regarded as a positive inconvenience."

Yet, of course, tar was used for various purposes before Dr. Perkin obtained mauve from it. All the common uses of tar, for burning, paving, making roofing felt, creosoting timber, and as a cheap paint for iron and wood, were known and practised from early times in the history of gas supply. The preparation of creosote involved the distillation of the raw material, which resulted in the recovery of naphtha, and, later, of benzene. All these uses, however, failed, except in particular places, to give any real value to tar, the consumption of which was strictly local. Perkin was undoubtedly the first to render tar distilling profitable; and his discovery was fruitful of many others. His was the "mother idea," from which, in due time, the discoveries of alizarine and those of the well-known antiseptics and drugs were to spring. Not many men have been so distinguished. Perkin will stand before the retrospection of posterity beside Leblanc, Bessemer, and Siemens, as a creator not only of new industries, but also of new lines of thought. The gas industry owes much to Perkin; but the community owe infinitely more. If neither he nor any like him had arisen to unlock the hidden possibilities of coal tar, the gas industry would have been damaged far less than many other of the beneficiaries of Dr. Perkin's triumph.

Let us explain. We do not seek to detract in the smallest degree from the glory that surrounds Dr. Perkin's name. What we do say, however, is that the gas industry *per se* would not have been seriously hampered if he had happened to turn his attention to another object than tar. This statement may appear startling to the popular chemical lecturers already referred to; but the simple fact that, up to the present year, a good deal of the tar produced in London gas-works was actually burnt at a profit under the retorts, and had been so disposed of for some years, is sufficient to prove our case. Now, gas makers could always burn their tar, before the day of Perkin's discovery as well as after it; and the circumstance that so many years after this discovery had borne fruit a thousandfold in the chemical trades, it should still pay to burn tar rather than sell it for distillation, throws a lurid light upon the economic results of Perkin's epoch-making work. The popular lecturer cannot be expected to grasp the significance of this fact, even if he is cognizant of it; but it is of the most obvious importance to the gas industry that such a piece of evidence should not be lost sight of. Lunge has an instructive passage on this aspect of the subject. He says:

> In the course of time, the following state of affairs has established itself. In England, where by far the largest quantity of gas-tar is produced, where benzene was discovered by Faraday, its industrial preparation by Mansfield, the first aniline colour by Perkin, and where the conditions are the most favourable for the purchase of the necessary chemicals as well as for the sale of the colouring matters, the manufacture of artificial dyes has only risen to moderate dimensions. The same has taken place in France. On the other hand, in Germany and Switzerland, the manufacture of coal-tar colours has been established on an enormous scale, so that the tar produced there can only supply a small portion of the benzol and anthracene required; the larger portion being imported from England and France, partly in the form of aniline. But the employment of the other coal-tar products, especially dead oil and pitch, in Germany, has by no means increased *pari passu* with that of benzol and anthracene; the former—very cheap articles—would frequently have to seek a market at such distances that the expense of carriage would become excessive. Moreover, gas making in Germany is only partially concentrated at a few large centres of industry. Very many small gas-works are scattered over the country, sometimes not even situated near a railway line, and hardly ever on the bank of a canal or navigable river; so that the collecting of tar for a large distillery does not pay. Hence in Germany and in Switzerland, just where the manufactue of coal-tar dyes has reached its greatest development, it frequently happens that the tar produced at the gas-works has to be burnt under the retorts.

This paragraph puts the case of the tar-colour industry in relation to the coal-gas industry upon a footing which admits of easy examination. The whole question is a commercial one. The value of coal tar depends upon the value of all its components and derivatives; and the worth of these is determined by what they can be made for, and what they will fetch. Many, indeed most, of these considerations are so far removed from the original producers of the article, regarded as a raw material, that they scarcely affect their dealings with it. Thus the difference of profit to a gas undertaking where the tar is worked up, as compared with another where it is disposed of by sale at the market price, is easily neutralized by very simple considerations. In the first place, few gas-works have the necessary spare land for the erection of tar-works; and in others the fear of causing nuisance prevents all such additions to the ordinary process of gas making. And, after all, bad management in the sale department may render nugatory the best work in the factory. Under the most favourable circumstances, the conversion of tar in a gas-works can never be carried far. The proximate results of tar distillation can alone be produced for the market, in such circumstances, with any reasonable hope of profit, because the quantity of the most valuable of these is insufficient, in all but the largest establishments, to afford, in its further conversion, profitable employment for the necessary staff. This is readily apparent in respect of a particular description of tar product which is very much in the popular mind at present—we refer to "saccharine." A single factory could take all the saccharine-yielding tar product of a country. We do not know the precise form in which the makers of this article prefer to purchase their raw material; but it is obvious that there are a great many tar products which they do not want. So it is, as Lunge witnesses, with the dye makers of Germany and Switzerland. If these were compelled to take with their aniline and anthracene, which they can profitably work up, the creosote and pitch for which they have no use, they could not pay so highly for the former as they do. The actual subdivision of the tar-products trade corresponds to very real market conditions, and is not, as some would have us believe, a result of German or Swiss enterprise as contrasted with English stupidity. In England, pitch and heavy oils are at least saleable. In Germany, the skilled labour needed to work up aniline into dyes is cheaper than in England. It is perhaps for a similar reason that the trade in coloured papers, colour printing, &c., is largely centred in Germany. Notwithstanding this advantage, however, the coal-tar colour trade is not confined to that country; some of the best-known dyes being manufactured by English firms.

The point we wish to make in regard to this matter is that while the discovery of Perkin unquestionably imparted to coal tar in bulk a stable value that was previously lacking, yet the coal-tar colours and chemicals trade is so far removed from its origin in tar distilling, that the economic condition of the one is not so regularly reflected in that of the other as the general public are usually persuaded is the case. We do not undervalue the work of Perkin and his followers; but we cannot forget that for years after Feldmann had astonished the world with saccharine, most of the gas-works in the United Kingdom were burning their tar because it was practically unsaleable for any other purpose.

Discovery of Coal at Middlesbrough.—The Newcastle Chemical Company have struck a seam of coal 2 feet thick at a depth of 1970 feet from the surface at Cowpen, near Middlesbrough. The coal has been analyzed, and found to be of a very good quality. The firm were boring experimentally with the expectation of finding natural gas. It is believed there is a considerable quantity of coal beneath the seam.

NOTES.

Becquerel on Phosphorescence.

M. Henri Becquerel has recently studied the different manifestations of the phosphorescence of minerals under the influence of light and heat, and has communicated some observations upon the subject to the *Comptes Rendus*. The result of M. Becquerel's experiments up to the present time is to place the phenomenon of phosphorescence induced by heat, hitherto considered as distinct from all other phenomena of the kind, once more into the class of known and studied phosphorescence effects. One fact in particular deserves attention in connection with this subject—the conservation to an indefinite time in certain bodies of a portion of the energy which they have absorbed, and which they emit upon being heated. M. Becquerel asks by what mechanism this energy is thus maintained in its potentiality without appreciable loss. He declares himself unable for the present to answer this question; but he looks to future research for information upon the subject, which may have the most important bearing upon the state of knowledge of the mechanism of light-radiation and the storing of energy in its highest and most intense forms.

Coal-Tar Concrete.

A discussion at a meeting of the American Society of Civil Engineers of a paper describing the use of natural asphaltum as cementing material in the construction of sea walls, turned largely upon the possibility of employing coal tar for similar purposes. The paper was by Mr. W. C. Ambrose; and it described how, on the Pacific coast, natural Californian asphalte had been successfully used to make a kind of concrete for facing breakwaters. This material required to be melted by the help of coal tar or crude petroleum oil. The author admitted that the question of cost must govern the employment of any such material; and he stated as his opinion that where the asphalte can be had for $10 per ton, it can be advantageously employed in making concrete. It was remarked in the discussion that the idea of asphalte concrete is not a new one; but the cost of European natural asphalte prohibits its uses for this purpose. Mr. Collingwood observed that there might be many points where ordinary coal tar would be a most useful material for cementing walls. It is not so durable as natural asphalte; but it is much cheaper, and is capable of effective use. Mr. Greene remarked that the durability of coal tar in paving or any similar use depends upon the degree to which it is protected from oxidation. The outside wears away if exposed to air and moisture, the oil evaporates, and the material loses coherence. In large masses, Mr. Greene thinks, tar concrete would be comparatively durable. For machinery foundations in towns it is particularly useful, as its permanent elasticity destroys all vibration from steam-engines, hammers, &c.

The Father of the Gas Industry in the United States.

In the course of a paper read before the American Society of Civil Engineers, Mr. W. E. Worthen, a Past-President of the Society, made incidental reference to the introduction of gas lighting upon a large scale into New England. He stated that this was done by Mr. Aaron Manby, then of the Horseley Iron-Works, at Tipton, who was compelled to use old musket-barrels for the conveyance of the gas. The breech ends of the barrels were broached and tapped, and the muzzles were screwed externally, in order that the barrels might be joined together without detached sockets. From the rapid increase of gas illumination, old gun-barrels soon became scarce, and the "gun-barrel" tube manufacture came into existence, commencing with Russell's patent of 1824 for making butt-welded tubes by a mixed hand and machine process, in which the metal was first bent up by hand hammers and swages until the edges came near together, when they were welded between semi-circular swages, fixed respectively in the anvil and on the face of a small tilt hammer, with or without a mandril. The tube was completed by being passed between rollers with half-round grooves, which forced it over a conical or egg-shaped piece at the end of a long bar, to perfect the interior surface. Mr. Worthen, who speakes in another place of events that happened in 1840 as being well within his personal recollection, does not give the date of Mr. Manby's adventure. The historical reference to the father of gas lighting in America is, however, very interesting. This is, so far as we are aware, the first mention of Mr. Manby's name in this capacity; and it would be instructive to know whether any other record of the incident exists. Mr. Worthen's testimony respecting the actual adaptation of old gun-barrels to the purpose of conveying gas is also valuable. Elsewhere than in the United Kingdom it therefore appears that the weapons which the cessation of the universal state of warfare that ushered in the century rendered useless for their primary purposes, were utilized in this remarkable manner. The popularization of gas lighting came just about the era when the prolonged peace that followed the overthrow of Napoleon I. turned men's minds from the glories of war to the triumphs of industry; and the conversion of musket-barrels into gas-pipes was a perfectly natural sign of the time. The name "gun-barrel tubing" helps to perpetuate the memory of this conversion; but the term is used so conventionally that its historic validity may be easily overlooked. There can be few now living who remember when gun-barrel tubing for gas was really what the name implies.

TECHNICAL RECORD.

SOCIETÉ TECHNIQUE DU GAZ EN FRANCE.

The Papers Presented at the Annual Congress.

We have already published (*ante*, p. 18) an abridged report, translated from the *Journal des Usines à Gaz*, of the general proceedings at the recent congress of the above-named Society in Paris. We now give, from the abstracts which have appeared in that publication, an outline of the principal papers presented on the occasion.

First in importance are the two memoirs sent in in competition for the Society's prizes. One of these was on the subject of the heating of gas-retort furnaces; the other dealt with the legal relations of municipalities and lighting companies. These essays were subjected to a critical examination by the Committee of the Society, who had a special meeting for the purpose of discussing their merits and utility. The result was that they requested the writer of the first (who turned out to be M. Guéguen, the Editor of the *Journal de l' Eclairage au Gaz*, and author of the elaborate papers on the "Chemical Theory of the Production of Illuminating Gas" which were presented to the Society a few years ago, and translated into our columns) to allow his work to be submitted to the meeting and discussed. This he agreed to do; and the full text of the paper has been given in the publication of which he is the technical director. It will be sufficient here to reproduce the summary furnished by the Committee of the Society. After an introduction consisting of a recapitulation of the general knowledge on the subject, the author treats the question under three heads: (1) The production of heat; (2) the communication of this heat to the retorts; and (3) the transmission of heat through the walls of the retorts to the materials in process of distillation. There are three notes, which are intended to demonstrate certain propositions or to justify assertions contained in the paper. The author takes as his starting-point a communication read by M. Melon to the Society in 1881, on the "Utilization of Heat in Gas-Ovens," and expresses the opinion that it is not advisable to confine oneself to the single experimental datum furnished by the analysis of the products of combustion, and to general considerations borrowed from treatises on physics. He therefore proposes to ascertain by experiment the principal causes of loss of heat, and to proceed farther with the analysis of the distribution of heat in furnaces. After having reproduced the figures of M. Melon, the author gives calculated and experimental results corresponding to certain determined conditions of work for a setting of seven retorts. In this way, he shows that the distillation of coal utilizes only a very small quantity of the heat furnished by the combustible employed to produce it; and having satisfied himself that this fact is in accordance with the data of thermo-chemistry, he formulates this proposition: That all the improvements which are desirable from the standpoint of combustion and the obtaining of high temperature have been very nearly effected; and that further improvements are only realizable by studying the action of flames, and by facilitating the passage of heat to the mass of coal itself. A few explanations are considered indispensable by the author in order to make clearer the exposition of his personal views; and the chapter on the production of heat is devoted to recapitulating principles and demonstrating their application. These explanations, in the opinion of the Committee, require to be still further extended on many points.

The next matter discussed relates to the communication of the heat to the retorts. Having stated that gas-retort furnaces are heated by the radiation of flame, the author passes on to the law of the reduction of the temperature of flames traversing these furnaces. He calculates the quantities of heat absorbed by the process of distillation in order to produce, per charge of 150 kilos. of coal, 105 kilos. of coke at 1200° C., and 45 kilos. of volatile products escaping at 500° C., and he comes to the conclusion that during distillation there is in the retort an average temperature of 753° C. He afterwards takes as his authority a formula of M. Ser (in his *Traité de Physique Industrielle*) to make calculations upon retorts of which he supposes the walls to be formed first of thin sheet iron, and then of fire-clay 2¾ inches thick. Here he brings in, without, however, strictly defining it, the internal calorific energy of flames, which the Committee consider would have been much better placed in the chapter devoted to the production of heat. From these developments, which they think are a little confused and purely theoretical, M. Guéguen concludes once more that the heating of retort-furnaces is effected by a current of hot gas passing through the burnt gases which remain there. He adds: (1) That there is a production which is suitable to each furnace, and which should be determined by observing the temperature of the flames at their point of exit; (2) that the transmission of heat goes on so slowly through the fire-clay walls, that, at temperatures below 1200° C., there is really no longer any great advantage in causing the flames to play round new retorts; (3) that if there were placed in the setting, after the fire-clay retorts, two or four retorts of cast iron, it would be possible to utilize the

combustion gases up to 800° or 900° C., and that the saving would then be considerable; (4) that the contrivances having for their object the better protection of the flames against losses by exterior radiation would, in effect, only increase the temperature of the gases at the point of their exit from the settings; (5) that it is impossible to escape the dilemma of either increasing the number of retorts, so as to prolong the period of action of the flames, or to employ arrangements which enable the retorts to better conduct heat. The Committee think that certain of these statements, if not the whole of them, are open to criticism.

We now come to the last chapter of this very elaborate paper, in which the author discusses the question of the transmission of heat through the substance of the retorts to the materials in course of distillation. He states the problem as follows: In a setting of seven retorts, having a total surface of 5·160 square metres available for the transmission of heat, 1,723,734 calories pass off every 24 hours—a number corresponding to 2011 calories per hour per square metre of furnace. How will this quantity vary with the thickness of the walls? Starting with a classical formula, and assigning certain of its somewhat arbitrary values to unknown quantities such as the co-efficients of radiation and convection of the walls, calculation teaches him that the quantities of heat passing through per square metre per hour range between 3881 and 1625 calories for thicknesses varying from 1 to 10 centimetres (0·4 inch to 4 inches). Here it is a question of fire-clay retorts. The author considers it to be useful afterwards to resort to calculation for the purpose of demonstrating the influence of the conductivity of the walls. In the opinion of the Committee, this was not absolutely necessary, though the author is pleased to draw conclusions therefrom which are self-contradictory, at least to a certain extent. After this long exposition of his ideas and researches, Mr. Guéguen had only to draw his conclusions; and he does so in these terms: "It is in the direction of the improvement of the conductivity of the fire-clay walls that efforts should be directed, as much by the reduction of the thickness, by forming ribs on the outside according to requirements, as by incorporating with the clay such substances as may be capable of improving its heat-conducting power, such as graphite. The use of retorts composed entirely of the last-named substance seems to be capable of easy realization. It is doubtful if metal retorts can be advantageously employed alone; but utilized as supplementary surfaces, to exhaust the energy of the flames, it would seem that they ought to prove satisfactory whenever occasion serves for the reconstruction of a retort-setting to fresh dimensions."

The importance of the question of heating retorts, and the amount of labour evidently bestowed by the author in preparing his *mémoire*, made it incumbent upon the Committee to present to the Society as complete an analysis as possible of the new ideas and the scientific investigations contained therein, and their consequences; indicating, in passing, the points specially open to criticism. Having thus done justice to the efforts of the author, the Committee thought that a paper so full of unpublished documents was less suitable for private examination than for public discussion, in which the members of the Society would find it to their interest to take part, in order to acquaint themselves with the nature and extent of the improvements proposed. This would afford the author an opportunity of more freely expressing his views, and bringing them within the comprehension of all. As already mentioned, this was done; and the paper gave rise to a good discussion. The points raised by the various speakers who took part therein were as follows: M. de Lachomette referred to the thickness of the walls of retorts, which he said is not less than 2·4 inches, and more often 2·6 or 2·8 inches; M. Devaluez gave some particulars in regard to the distillation of gas coal in retorts made of cast steel 1·2 inches thick (the charges remaining in them 3½ and 4 hours), which did not last more than twelve days; and M. Cornuault pointed out the inconvenience of employing graphite retorts, which, he said, would be too costly. With respect to this last matter, however, it was thought that the conductivity of retorts might be increased by the admixture of graphite in the material of which they are constructed.

The other memoir was by M. Vanderpol. It consisted of a collection of the judgments of the Courts bearing upon the interpretation of contracts entered into between gas and water companies and the municipal authorities of the towns served by them, preceded by some general considerations on the legal aspect of these concessions and of the privileges granted by highway authorities as to opening streets, the powers of Mayors, and the abuse thereof. The Committee complimented the author on the methodical way in which he presented the results of his researches; thereby greatly facilitating reference on the part of anyone desiring information on the subject dealt with. At the same time they considered some of his theories must be accepted with reserve, while certain of the principles enunciated, especially where they are in opposition to acquired rights, ought to be combated.

Coming now to the ordinary papers, the first was a short one read by M. Chevalet, in which the author gave the results obtained with a feed-water heater devised by him, which, as he claims, removes almost entirely the calcareous salts contained in water, and consequently prevents the incrustation of steam-boilers. The precipitation of the salts is effected by the injection of steam into the feed-water, which becomes gradually heated by passing through an apparatus analogous to a worm-still, until it reaches boiling-point, at which it is taken off. According to the remarks which followed the paper, there was nothing surprising in the removal of salts of lime and magnesia in the way suggested; the point was what would be the consumption of steam to effect this. It was thought, too, that the advantages of the system over those at present employed should have been demonstrated by figures obtained as the result of its practical application. The next matter to occupy the attention of the members was one which more closely concerned them—viz., the guiding of gasholders. This was introduced by Mr. Brown, the representative of Mr. E. L. Pease, who showed a model of a gasholder guided by that gentleman's wire-rope system, and furnished a few descriptive details. M. Jouanne followed with a short paper on the Gadd and Mason system, which gave rise to some pointed questions as to the possibilities of hitches occurring in the working of the arrangement. Of course, the Northwich holder was indicated as affording an excellent opportunity for studying the advantages as well as the inconveniences of this method of guiding gasholders.

A communication by M. André, describing an arrangement of hydraulic main allowing the automatic suppression of the seal of the dip-pipes, was, in the author's absence, analyzed by one of the Secretaries. M. André's plan is to divide the main into as many independent sections as there are dip-pipes, and further to convert these sections into two compartments by a vertical partition which does not touch the bottom, and therefore allows the liquid in the main to pass from one to the other. During the process of distillation, the pressure of gas forces back the water in the hydraulic, and the dip is suppressed. When it is desired to open a retort-lid, it is necessary to prevent the re-entrance of the gas from the neighbouring retorts by way of the dip. There is then sent into the second compartment, from a small gasholder, a certain quantity of gas at constant pressure, under the influence of which the water passes into the first compartment, and restores the seal. Some rather ingenious, but at the same time complicated, arrangements enable the various operations to be easily carried out. Some modifications effected by M. Chevalet in his "rational" scrubber, described at a previous meeting, next came before the members. This scrubber is furnished with wood chips, and by its use the author claims that he can obtain from each ton of coal carbonized from 3·3 to 4·4 lbs. of nitrogen in the form of ammoniacal liquor concentrated to 7° to 8° Baumé. At the Meulan Gas-Works, where the make is about 25,000 cubic feet of gas per day, something like 5½ gallons of liquor of this strength are obtained. The tar in the gas is at the same time taken out by the chips, and the purification process consequently much simplified. The pressure absorbed by the scrubber does not exceed 4-10ths.

M. Wehrlin next presented to the meeting a few practical considerations on the subject of gas-engines, with the construction of which the author has for some years been familiar. Without attempting to set up a comparison between the numerous types of engines now offered to the public, the author reviewed the various points to which attention should be directed by everyone purposing to purchase and fit up a motor—viz., consumption of gas per horse power per hour, cooling of the cylinder, ignition, regulation, distribution, lubrication, &c. M. Wehrlin's observations were presented simply and clearly; and therefore his paper was suitable for placing in the hands of consumers. In the discussion upon it, stress was laid on the two points of cooling and lubrication, and the relation existing between them. M. Chauveau, who is also an authority on this subject, followed with a paper giving the unpublished results of some trials of a Charron gas-engine. A striking feature of this communication was the statement that the consumption of gas per effective horse power per hour was only 22 cubic feet—a low figure which the author explained was the result of strong compression of the explosive mixture. His conclusions gave rise to some adverse comments, M. March presented a short communication in which he described a scheme for a new gas generator furnace burning coke dust or breeze. He pointed out that there are two great obstacles in the way of burning coke dust in ordinary furnaces—one being the difficulty which the air required for combustion finds in traversing the too compact layer of fuel; the other, the separation of the ash. The author claimed that with the special form of generator devised by him he had overcome these inconveniences, by the large free surface of the fire-bars, by reducing the thickness of the layer of combustible, and by the gradual deposition of the ash in the lower part of the generator. According to the remarks to which the paper gave rise, the utilization of breeze is possible, and is already actually carried out, without any alteration of the essential parts of existing furnaces; but it was thought that the arrangement of M. March might well be adopted in the event of some new ovens having to be constructed.

The next paper—submitted by M. Coindet—dealt with the automatic regulation of the pressure in gas-mains from the centres of distribution. It is difficult, without drawings, to explain by what combination of mechanism these results are attained; but the plan seems to be to erect warning-posts in various parts of the district, and to transmit therefrom to the works electric signals, produced by altering the position of a

regulator bell, to put on or take off pressure. It is said that the arrangement allows of the regulation of the pressure to 0·08 of an inch; and the proof of its efficiency is to be found in the fact that complaints, which before its adoption were frequent, have now completely ceased. Two papers on the treatment of ammoniacal liquor next came before the members—one by M. Mallet, the other by Mr. Hodgson Jones. That of the former gentleman was not printed; and in Mr. Jones's communication he describes the system which has been in use for some time at Beckton, with, it is stated, excellent results. M. Guéguen dealt with the subject of the verification of gas-meters *in situ*. His plan is to have a flask made to hold, between two marks, exactly 7 litres (0·25 cubic foot), and with this to test the capacity of the drum of the meter. It was thought that the apparatus, which is easy of manipulation, might render considerable service in settling disputes.

The other subjects brought before the meeting do not call for notice; the only important one being a paper prepared by M. Delahaye on the gas and electric light undertakings of Massachusetts, in which the author gave some interesting statistics extracted from the report of the Commissioners of that State for the year 1889-90, which has already been fully noticed in our columns.

THE RATE OF EXPLOSIONS IN GASES.

At a recent Meeting of the Royal Institution, Mr. HAROLD B. DIXON, M.A., F.R.S., Professor of Chemistry in Owens College, Manchester, read a paper on the above subject. It was based on the lecture delivered by him before the British Association, at their meeting in Manchester, in 1887, which was fully reported in the JOURNAL at the time;* but, in view of the value which attaches to Mr. Dixon's investigations on this matter, his latest communication will doubtless be read with interest.

The rapid act of chemical change which follows the kindling of an explosive mixture of gases has of late years attracted the interest both of practical engineers and of theoretical chemists. To utilize for motive power the expansive force of ignited gases, to minimize the chance of disastrous conflagrations of fire-damp in coal mines, and to follow the progress of chemical changes under the simplest conditions, are some among the problems presented to us in industry or science, demanding for their solution a knowledge of the phenomena of the explosions of gases. To understand the nature of explosions in gases, it is necessary to know certain fundamental properties of the explosive mixture. With this object in view, experimenters have sought to determine, for various mixtures of gases, the heat of chemical combination, the temperature of inflammation, the pressure developed, and the rate at which the explosion is propagated under different conditions. It is on the last of these problems—the determination of the velocity with which the flame travels through the gas—that I have been asked to speak.

Some 24 years ago, Bunsen described a method of measuring the rapidity of the flame in gas explosions. Passing a mixture of explosive gases through an orifice at the end of a tube, and igniting the gases as they issued into the air, he determined the rate at which the gases must be driven through the tube to prevent the flame passing back through the opening and exploding inside the tube. By this method he found that the rate of propagation of the ignition of hydrogen and oxygen was 34 metres per second; while the rate of ignition of carbonic oxide and oxygen was less than 1 metre per second. Bunsen applied these results to the rate of explosion of gases in closed vessels; and his results were accepted without cavil for 14 years.

By 1880 facts began to accumulate which seemed inconsistent with Bunsen's conclusions. For instance, between 1876 and 1880, I had several times observed that the flame of carbonic oxide and oxygen travelled in a long eudiometer too quickly to be followed by the eye. Mr. A. V. Harcourt, in his investigation of an explosion which happened in a large gas-main near the Tottenham Court Road in 1880, was led to the conclusion that the flame travelled at a rate exceeding 100 yards per second.† In the winter of 1880-1, I noticed the rapid increase of velocity as a flame of carbon bisulphide with nitric oxide travelled down a long glass vessel; and shortly afterwards, I attempted to measure the rate of explosion of carbonic oxide and oxygen by photographing on a moving plate the flash at the beginning and the end of a long tube. The two flashes appeared to the eye to be simultaneous; but no record of the rate was obtained, for the apparatus was broken to pieces by the violence of the explosion.

In July, 1881, two papers appeared in the *Comptes Rendus*—one by M. Berthelot, the other by MM. Mallard and Le Chatelier. Both papers announced the discovery of the enormous velocity of explosion of gaseous mixtures. Other papers quickly followed by the same authors. M. Berthelot made the important discovery that the rate of explosion rapidly increases from its point of origin until it reaches a maximum which remains constant, however long the column of gases may be. This maximum M. Berthelot states to be independent of the pressure of the gases, of the material of the tube, and of its diameter above a small limit. The rate of explosion thus forms a new physico-chemical constant, having important theoretical and practical bearings. The name *l'onde explosive* is given by Berthelot to the flame when propagated through an explosive mixture of gases at the maximum velocity.

While Berthelot, associated with Vielle, was measuring the rate of the "explosion-wave" for various mixtures of gases, MM. Mallard and Le Chatelier continued the study of the preliminary phenomena of explosion which precede the formation of the "wave." They showed, by photographing on a revolving cylinder, (1) that when a mixture such as nitric oxide and carbonic bisulphide is ignited at the open end of a tube, the flame travels a certain distance (depending on the diameter and length of the tube) at a uniform velocity; (2) that at a certain point in the tube, vibrations are set up which alter the character of the flame, and that these vibrations become more intense—the flame swinging backwards and forwards, with oscillations of increasing amplitude; and (3) that the flame either goes out altogether, or that the rest of the gas detonates with extreme velocity. Again, when a mixture of gases was fired near the closed end of the tube, they found the velocity of the flame regularly increased, as far as their instruments were able to record the rapidly increasing pace. Mixtures of coal gas with air, and of fire-damp with air, show phenomena of the first and second kind. Ignited at the open end of a tube, these mixtures burn at a uniform rate for a certain distance, and then the flame begins to vibrate. The vibrations acquire greater or less velocity according to the nature of the mixture and the conditions of the experiment; but the third *régime* of uniform maximum velocity is not set up. In narrow tubes the explosion soon dies out. The phenomena studied by MM. Mallard and Le Chatelier have been observed on a large scale in explosions in coal mines. It has been noticed that little damage was caused at the source of an explosion, and for a distance varying from 50 to 80 yards from the origin of the flames; while, beyond that distance, fall of roof, broken tubes, and blown-out stoppings have testified to the violence exerted by the explosion. Great as the destruction is which an explosion of fire-damp and air causes in a mine, it is fortunate that these mixtures do not detonate.

Passing on to Berthelot's researches on the *régime* of detonation, I will briefly summarize the results he has arrived at. The actual velocities of explosion are compared by Berthelot with the mean velocity of translation of the gaseous products of combustion, supposing these products to contain all the heat that is developed in the reaction. For instance, we know the total heat given out when hydrogen and oxygen combine. If this heat is contained in the steam produced, we can calculate what its temperature must be if we know its heat-capacity. And if we know the temperature of the steam, we can calculate the mean velocity with which the molecules must be moving. Now, Berthelot supposes that the heat is all contained in the steam produced. He assumes that the heat-capacity of steam is the same as the sum of those of its constituents; and he considers, moreover, that the steam is heated at constant pressure. Making these assumptions, he calculates out the theoretical mean velocity of the products of combustion of various mixtures, and finds a close accordance between these numbers and the explosion rates of the same mixtures. He concludes that the explosive wave is propagated by the impact of the products of combustion of one layer upon the unburnt gases in the next layer, and so on to the end of the tube at the rate of movement of the products of combustion themselves. If his theory is true, it not only accounts for the extreme rapidity of explosion of gaseous mixtures, and gives us the means of calculating the maximum velocity obtainable with any mixture of gases, but it also affords us information on the specific heats of gases at very high temperatures, and it explains the phenomena of detonation, whether of gases or of solid or liquid explosives. The following table shows the rates of explosion found by Berthelot, compared with the theoretical velocity of the products of combustion:—

TABLE I.—*Berthelot's Experiments.*

Gaseous Mixture.	Velocity in Metres per Second. Theoretical.	Found.
$H_2 + O$ Hydrogen and Oxygen.	2830	2810
$H_2 + N_2O$ Hydrogen and nitrous oxide.	2250	2284
$CO + O$ Carbonic oxide and oxygen.	1940	1090
$CO + N_2O$ Carbonic oxide and nitrous oxide.	1897	1106
$CH_4 + O_4$ Marsh gas and oxygen.	2427	2287
$C_2H_4 + O_6$ Ethylene and oxygen.	2517	2210
$C_2N_2 + O_4$ Cyanogen and oxygen.	2490	2195
$C_2H_2 + O_5$ Acetylene and oxygen.	2660	2482
$CO + H_2 + O_2$ Carbonic oxide, hydrogen, and oxygen.	2236	2008

Two points in Table I. favoured the view that Berthelot might have here given the true theory of explosions—first, the close coincidence between the rates of explosion of hydrogen, both with oxygen and nitrous oxide, with the calculated mean

* See Vol. L., pp. 498, 538, 579.

† Mr. Harcourt's report will be found in the JOURNAL for Aug. 17, 1880 (p. 260).

velocities of the products of combustion; and, secondly, the great discordance between the found and the calculated rates for carbonic oxide with both oxygen and nitrous oxide. I had previously discovered that pure carbonic oxide cannot be exploded either with pure oxygen or pure nitrous oxide. The discordance found by Berthelot was what I should have expected from my own experiments.

A consideration of Berthelot's results, published in full in the *Annales de Chimie*, led me to think it would be useful to repeat and extend these experiments. My objects were chiefly (1) to determine as accurately as possible the rate of the explosion wave for some well-known mixtures; (2) to measure the rate of the explosion-wave in carbonic oxide with different quantities of steam; and (3) to determine the influence of inert gases on the propagation of the wave.

1. The results obtained with hydrogen and oxygen, with hydrogen and nitrous oxide, and with marsh gas and oxygen, in exact proportions for complete combustion, were in close accordance with the mean results of Berthelot. For ethylene, acetylene, and cyanogen, my numbers differed appreciably, but in no case by more than 7 per cent., from the rates observed by Berthelot. They are given in the following table:—

TABLE II.—*Velocity of Explosion in Metres per Second.*

	Berthelot.	Dixon.
Hydrogen and oxygen ($H_2 + O$)	2810 ..	2821
Hydrogen and nitrous oxide ($H_2 + N_2O$) . . .	2284 ..	2305
Marsh gas and oxygen ($CH_4 + O_4$)	2287 ..	2322
Ethylene and oxygen ($C_2H_4 + O_6$).	2210 ..	2364
Acetylene and oxygen ($C_2H_2 + O_5$)	2482 ..	2391
Cyanogen and oxygen ($C_2N_2 + O_4$)	2195 ..	2321

The general agreement between these measurements left no room for doubt about the substantial accuracy of Berthelot's experiments. The formula he gives does, therefore, express, with a close degree of approximation, the rates of explosion of many gaseous mixtures.

2. The formula fails for the explosion of carbonic oxide with oxygen or nitrous oxide. This was to be expected if, in the detonation of carbonic oxide in a long tube, the oxidation is effected indirectly by means of steam, as it is in the ordinary combustion of the gas. Measurements of the rate of explosion of carbonic oxide and oxygen in a long tube showed that the rate increased as steam was added to the dry mixture, until a maximum velocity was attained when between 5 and 6 per cent. of steam was present.

3. When electrolytic gas was mixed with an excess of either hydrogen or oxygen, the rate of explosion was found to be altered; the addition of hydrogen increasing the velocity, and the addition of oxygen diminishing it. The addition of an inert gas (nitrogen), incapable of taking part in the chemical change, produced the same effect as the addition of oxygen, one of the reacting substances; only the retarding effect of nitrogen was less marked than that of an equal volume of oxygen. The retardation of the explosion-wave caused by the addition of an inert gas to electrolytic gas evidently, therefore, depends upon the volume and the density of the gas added. In the following table, the retarding effect of oxygen and nitrogen on the explosion of electrolytic gas is compared:—

TABLE III.—*Rate of Explosion of Electrolytic Gas with Excess of Oxygen and Nitrogen.*

Volume of oxygen added to $H_2 + O$	O_1	O_3	O_5	O_7
Rate	2328	1927	1690	1281
Volume of nitrogen added to $H_2 + O$	N_1	N_3	N_5	N_7
Rate	2426	2055	1822	—

I think it a fair inference from these facts to conclude, when the addition of a gas to an explosive mixture retards the rate of explosion by an amount proportional to its volume and density, that such added gas is inert as far as the propagation of the wave is concerned, and that any change which it may undergo takes place after the wave-front has passed by—in other words, is a secondary change. This principle has been applied to determine whether in the combustion of gaseous carbon, the oxidation to carbonic acid is effected in one or two stages—an important question, on which there is little experimental evidence. If, for instance, in the combustion of a hydrocarbon, or of cyanogen, the carbon is first burnt to carbonic oxide, which subsequently is burnt to carbonic acid, the rate of the explosion-wave should correspond with the carbonic oxide reaction, in this case the primary reaction; whereas, if the carbon of these gases burns to carbonic acid directly in one stage, then the rate of the explosion-wave should correspond with the complete reaction.

Now, if we adopt Berthelot's formula as a working hypothesis, we can calculate the theoretical rates of explosion of marsh gas, ethylene, or cyanogen: (1) On the supposition that the carbon burns directly to carbonic acid; and (2) on the supposition that the carbon burns first to carbonic oxide, and the further oxidation is a subsequent or secondary reaction. On the first supposition, if 100 represents the rate of explosion of these three gases burning to carbonic oxide, the addition of the oxygen required to burn the gases to carbonic acid should increase the rate of explosion: Marsh gas, 104; ethylene, 103; cyanogen, 107. Whereas if these gases really burn first to carbonic oxide, and the extra oxygen is inert in propagating the explosion-wave, then the addition of this inert oxygen would diminish the rate of explosion: Marsh gas, 92; ethylene, 88; cyanogen, 87. The experiments show that, if 100 be taken as the rate of explosion when the oxygen is only sufficient to burn the carbon to carbonic oxide, the following are the rates found when oxygen is added sufficient to burn the carbon to carbonic acid: Marsh gas, 94; ethylene, 92; cyanogen, 84. The results are therefore in favour of the view that, in the explosion of these gases, the carbon is first burnt to carbonic oxide.

But stronger evidence on this point is obtained by comparing the rate of explosion of these gases (1) when fired with oxygen sufficient to burn the carbon in them to carbonic acid, and (2) when nitrogen is substituted for the oxygen in excess of that required to burn the carbon to carbonic oxide. We have seen that oxygen added to electrolytic gas hinders explosion more than nitrogen. In precisely the same way oxygen added to a mixture of equal volumes of cyanogen and oxygen hinders explosion more than the same volume of nitrogen. The conclusion we must come to is that the oxygen added to the mixture expressed by the formula $C_2N_2 + O_2$ is as inert (so far as the propagation of the explosion-wave is concerned) as oxygen added to the mixture expressed by the formula $H_2 + O$. The same phenomena occur in the explosion of marsh gas, ethylene, and acetylene. In all these cases the substitution of nitrogen for the oxygen required to burn the carbon from carbonic oxide to carbonic acid increases the velocity of the explosion. These facts seem only consistent with the view that the carbon burns directly to carbonic oxide, and the formation of carbonic acid is an after-occurrence.

Finally, the rates of explosion of cyanogen and the hydrocarbons, when their carbon is burnt to carbonic oxide, have been found greater than the velocities calculated from Berthelot's formula. This accords with the observation previously made, that the rate of explosion of electrolytic gas, with excess of either hydrogen or oxygen, is far higher than the calculated rate. It would seem probable that the theoretical rates, as calculated by Berthelot, should be modified, in spite of the close agreement which his numbers show. I think that the low rates found when hydrogen, marsh gas, cyanogen, &c., are exploded with equivalent proportions of oxygen, depend partly on the carbon burning to carbonic oxide, and partly on the dissociation of the steam at the high temperature. If the formula is modified in these respects, velocities can be calculated which agree with the experimental results where dissociation does not occur. I suggest the following modifications: (1) The specific heats should be taken at constant volume, instead of at constant pressure; (2) the density of the gas should be taken as the mean of the burnt and the unburnt molecules, instead of that of the burnt molecules alone; and (3) a correction should be made for the alteration of volume by the chemical reaction, which in some cases increases, in others diminishes, the volume.

The rates so calculated agree with the rates of explosion of cyanogen when burnt to carbonic oxide either by oxygen, nitrous oxide, or nitric oxide; with those of hydrogen and oxygen with a large excess either of hydrogen, oxygen, or nitrogen; with those of ethylene and acetylene with oxygen and a large excess of nitrogen; and, lastly, with those of hydrogen and chlorine with an excess of hydrogen.

In conclusion, I would say that these experiments have amply confirmed the truth of Berthelot's statement, that the explosion-wave is a "specific constant" for every gaseous mixture; that it has been shown that the rate of explosion depends upon the primary reaction occurring, and that the determination of the rate may throw some light on what is now so obscure—the mode in which chemical changes are brought about; and, finally, that it does not seem impossible that a connection between the rate of the molecules and the rate of the explosion may be worked out, which will give us some definite information on points of high interest in the theory of gases.

THE COAL MEASURES OF SOUTH WALES.

At the Annual Meeting of the British Association for the Advancement of Science, which, as mentioned in our editorial columns, was opened at Cardiff last Wednesday, the President of the Geological Section (Professor T. Rupert Jones, F.R.S., F.G.S.) selected as the subject of his Inaugural Address the coal measures of South Wales. He gave an elaborate and compendious summary of facts, figures, estimates, and opinions relating to coal—giving a list of the books in which the history of coal is dealt with, and describing the coal-field of South Wales, the origin of coal, the area of the coal growth, the varieties of coal, the constituents of the coal measures and of coal, and the extent of the coal measures under the South of England. We extract from the address the following interesting passages:—

The black stones that burn probably came to be known by prehistoric people through accident, here and there, long before any notion of their worth to the community at large was entertained. Wood at first, and then charcoal, supplied fuel far into historic times, on every hand, except perhaps in China. In the first century of the Christian era, the Romans, occupying England, met with coal, and probably learnt its use from the natives. It seems, however, to have been disregarded during the Saxon conquest and domination of this island; but by the beginning of the

twelfth century, the use of coal was well in hand again, as shown by old charters relating to places in Scotland and the county of Durham.

At the present day, South Wales and Monmouthshire yield coal in greater quantity and of more value, by more than £1,000,000 sterling a year, than the coal-fields of Northumberland and Durham, or of Yorkshire and Derbyshire; and considerably more, by nearly £5,000,000, than that of the Clyde Basin and associated coal-fields of Scotland. Indeed, the annual value of the coal produced in South Wales with Monmouthshire may be said to be about £11,000,000 out of the whole £45,000,000 sterling estimated as the value of the coal at the pit's mouth throughout the United Kingdom. The great coal-field of South Wales has the especial credit of having supplied some of the earliest and most important facts and phenomena illustrative of the geological succession of the materials of the coal measures, and of the natural history of the coal itself.

Coal is now generally accepted as being a compressed and chemically altered mass of ancient vegetables. The tissue of some of the trees and other plants may be detected in the substance more or less distinctly by fracture, by burning, and in thin sections. In some cases trees occur rooted in the attitude of growth; their stems rising upwards and their roots remaining in or below the coal. The accumulation of coal as seams of varying thicknesses, in very numerous parallel beds, can be explained by the gradual and long-continued subsidence of long and wide tracts of old marginal sea-beds, estuaries, and lagoons, with adjoining lands, all more or less invested with vegetation. At the same time limited, isolated, and lenticular patches and nests of pure coal, usually in sandstone, have been probably due to floating masses of vegetation, matted plants and trees, becoming waterlogged and sinking in estuaries and shallow seas. Some highly bituminous coal, like cannel and torbanite, may have been due to limited accumulations of macerated plants rotting in water; or to the bursting of those natural reservoirs, like peat-bogs, and a local arrangement of the resulting flow of carbonaceous mud.

The valuable coal-field of South Wales, estimated by some to occupy 640,000 acres, and stated by others to be 906 square miles in extent, forms an irregular oval basin or trough lying east and west, about 56 miles long, from Pontypool to Carmarthen Bay, with a narrow extension westward beyond Carmarthen Bay, through Pembrokeshire, to St. Bride's Bay, about 17 miles long. The greatest width is about 16 miles. In 1881 there were 662 collieries at work. Looking at these coal measures alone, and considering that slow depression accompanied their formation, the mind is strained in estimating the time required for the gradual subsidence to 10,000 feet—with shallow water always in place, and jungle growing steadily after jungle, inundation following inundation at intervals—and is somewhat confused in reasoning on the possible causes and the exact processes by which not only the sinking of this region of the earth's crust was brought about, but how, in turn, the 10,000 feet of new accumulations and deposits were raised into the great undulations, which Professor Ramsay has described and depicted in his memoir, and how and when they were slowly worn down day by day into the present beautifully varied surface of South Wales and the adjacent country. The analogous coal-field of Nova Scotia, investigated by Sir W. E. Logan, Sir J. W. Dawson, and others, has a thickness of 14,570 feet, including 76 coal seams and 90 distinct stigmarian under-clays.

The coal of the British coal-fields exhibits every variety of composition between anthracite, which is nearly pure carbon, and the so-called bituminous coals, such as ordinary coal and cannel coal (hydrocarbons) rich in hydrogen. Anthracitic beds are rarely seen, except in districts where the strata have been much disturbed or peculiarly affected by other circumstances. Heat—whether direct or induced by pressure, vertical or lateral—has probably been the important agent in depriving coal of its hydrogen with some of its carbon, and thus changing it into anthracite. Neither in this latter nor in the compact cannel coal are the laminar structure and symmetrical jointing so distinct as in the ordinary coals. The last lose their volatile hydrocarbons also by exposure to the air, at outcrops and in open faults; hence they are not nearly so good for burning as those obtained at a greater depth. In the Franco-Belgian coal-field, the coals become more and more anthracitic as they pass down to greater depths. Both kinds, therefore, were of the same age in formation. In South Wales also, as already stated, the anthracite and the other coals are of one age. The squeezing, faulting, and inversions in the former field are accompanied by an alteration of the highly bituminous coals into dry coals and anthracite.

The formation and subsequent arrangement of coal and the coal measures have been so ordered that the blessings of civilization have been largely enjoyed wherever the fossil fuel at man's feet has been industriously worked by his hands, and carefully applied to the improvement of his social being. These labours of careful perseverance, and arts of skilful manipulation, have given special characters to those whose energies have been directed to coal mining and various manufacturing enterprises; and all conditions of society have been influenced thereby. So also the geologist, chemist, and botanist, seeking out the composition of the various coals, their local position and extent, their special natural history, the mode of passage from dead plants to first-rate fuel—in fact, aiming at a complete mastery over all the mazy events and complicated results of the coal formation—not only find a useful exercise of their cultivated intelligence and accumulated knowledge, benefiting all by the practical results, but they widen the mental culture of others, and show how the study of Nature is an indispensable element in good education, and necessarily productive of lasting benefit to society at large.

Light, heat, motion, fragrance, and colour are all now obtainable from coal. What more could the sun himself do for us? It is as if the sunshine that cherished the luxuriant jungles of the past had been preserved in the coaly mass of the buried trees. Indeed, the light and heat of former days, expended in thus converting carbonic acid and water into coal, are here stored up for man. By converting coal into carbonic acid and water, he can again evolve that heat and light, and use them in a thousand ways beneficial to his race—nay, essential to his very existence as a civilized being. Nevertheless, a great deal has yet to be learnt about the natural history of the coal measures, the order and extent of the special kinds of their animals and plants, the time occupied in formation, and the geographical and hydrographical conditions. At all events, we know that all their strata have been arranged in order, have been buried under circumstances favourable to production of the various coaly fuels, and then turned up in orderly disorder, ready to the hand of man, and well adapted for his use in this passage-stage of his civilization and development—helping him, when intelligent, active, careful, and persevering, to higher ends. For we cannot doubt that all things here are arranged for his better being, his progress towards more and more useful arts, wider ranges of science, and fitter aptitudes of life, of which as yet we have but little conception. We are still the early settlers in a beautiful world, whose capabilities, imperfectly known as yet, wait until higher developments of man can understand them fully, and apply the results to the general good.

Mr. F. J. Bancroft, Assistant Manager of the Barnet District Gas and Water Works, has just passed, in the first division, the Intermediate B.Sc. Examination at the University of London.

Gas Lighting for the Royal Palace at San Sebastian.—The Madrid Correspondent of *Industries* says that the new palace named "Miramar," at San Sebastian, which was erected by the Queen Regent of Spain according to the plans of an English architect, is to be lighted by gas.

Manchester District Institution of Gas Engineers.—The 87th quarterly meeting of this Institution is to take place next Saturday at Birkenhead under the presidency of Mr. T. O. Patterson, Assoc. M. Inst. C. E., the Gas Engineer of the Corporation. According to the programme which has been issued by the Honorary Secretary (Mr. S. S. Mellor, of Northwich), the members will leave the Central Station, Manchester, shortly after ten o'clock, and on their arrival at Birkenhead will, by permission of Messrs. Laird, visit the docks and inspect the ironclad *Royal Oak*. Luncheon will be partaken of in the Town Hall, on the invitation of the Gas and Water Committee of the Corporation; and afterwards the business will be proceeded with. Three new members—Mr. Cranshaw, of Tyldesley, Mr. W. T. Goodwin, of Congleton, and Mr. W. Taylor, of Glossop—will be proposed for election; and a paper will be read by Mr. T. Newbigging, C.E., on "Differential Rates." At the close of the business, the members will be conducted over the gas-works, where the Coze system of inclined retorts will be seen in operation. They will then be conveyed to Woodside Ferry, whence they will proceed to Eastham, in a steamer provided by the Ferry Committee. Tea will be served at the Ferry Hotel; and the rest of the time will be spent in inspecting (by permission of Mr. E. Leader Williams, C.E.) the Eastham Locks at the entrance to the Ship Canal.

Water-Meters.—At the recent meeting of the American Society of Civil Engineers, an interesting paper was read by Mr. J. Thomson on "Water-Meters." The author dealt with all the patents taken out for meters of this class since 1837; the first being for a diaphragm meter. Strangely enough, 50 per cent. of all the patents for these meters have been issued within the last 15 years in America, and in Great Britain within the last 20 years. The third and fourth United States patents were granted to John Ericsson in 1851. The first British patent was No. 4982 of 1824, and issued to William Pontifex, of Shoe Lane, London. The author described and illustrated by drawings the various water-meters. He ridiculed the position of the water-works engineer who, after letting 75 to 150 gallons per head run to waste day after day, suddenly rose to the occasion, and demanded a meter that would measure drops. For all practical purposes, a meter registering within 5 to 7 per cent. would, he said, be ample; and when engineers came to this decision, such meters could be had for 20 to 25 per cent. less than those now used. He thought there had not been any marked increase in accuracy, nor had any generic invention of special importance been made in water-meters for the past 20 to 25 years. He had not found aluminium so satisfactory as hard rubber, since it developed, when contained within ordinary brass castings with water, a galvanic action, and there resulted a deposit which interfered with its proper action. The perfect meter must be frictionless; but he thought rotary would supplant reciprocating piston and inferential meters.

REGISTER OF PATENTS.

Manufacture of Illuminating Gas from Town's Refuse.—Scudder, F., of Clapham, S.W. No. 10,313; July 3, 1890. [4d.]

For the purpose of this invention—which has reference to the manufacture of illuminating gas and other useful products (for example, sulphate of ammonia) from town's refuse—the material, after being screened and hand picked to remove part of the non-combustible bodies therefrom, is charged into a gas producer of any suitable construction designed to produce either ordinary producer gas or water gas, wherein it is burnt with the aid of air, or air and steam, in the usual manner for the production of gases therefrom. It will generally be advantageous to mix with the refuse material a certain proportion (say, about 10 per cent.) of fuel—such as coal or coke—to ensure its proper combustion, and also a suitable proportion (say, from 1 to 2½ per cent.) of lime, or an alkali that will act as a flux to the earthy matter present in the refuse, and aid the production of ammonia from the nitrogenous matters present. For the latter purpose, it is also advantageous to use a producer constructed to produce water gas.

Two or more producers are preferably used in combination. The water gas, which is made by steam passing from the top to the bottom of the generator through the fuel in it, composed of refuse material and other fuel of the kind referred to, and previously rendered incandescent by combustion with air, passes out at a high temperature; and the gases thus produced are led through a second generator, preferably charged with coke, in order to decompose any steam or undecomposed hydrocarbons which may be carried forward with the water gas. It may be advantageous, says the patentee, under certain circumstances, according to the fuel employed, to alter the positions of the opening through which the blast and also the steam enters the producer, and to use a portion of the producer gas to heat the producer containing the coke which generates water gas. The producer gas or the water gas thus produced, and containing carbonic oxide and ammonia gases, is passed through an air condenser, wherein it is cooled down to a temperature of (say) about 300° Fahr. They are then passed through strong sulphuric acid, whereby the ammonia is absorbed and converted into sulphate of ammonia, which crystallizes out and is removed from time to time; while the carbonic oxide and other non-absorbable gases present are passed forward for use for illuminating or heating purposes.

The sulphuric acid may have a strength of about 140° Twaddel; and the temperature to which the producer gases are cooled is such (say, 300° Fahr.) that these gases will not heat the sulphuric acid sufficiently to cause its volatilization, but merely sufficient to prevent the condensation of water therein. When the sulphate of ammonia crystals are removed, a corresponding quantity of fresh sulphuric acid is run into the saturator, so as to maintain the strength of the acid.

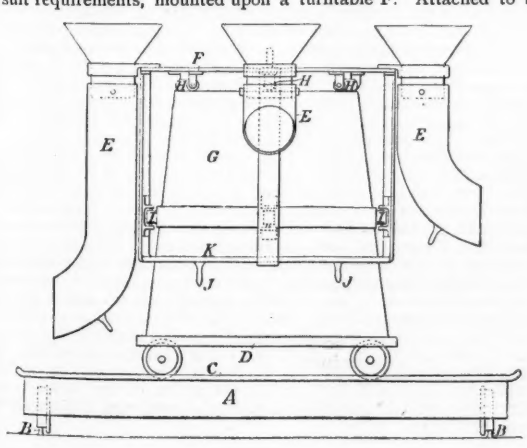
Treatment of Tar and Pitch.—Nevill, W. H., of Ferryside, South Wales. No 13,398; Aug. 26, 1890. [4d.]

This invention, says the patentee, has for its object "the treatment of tar, or a mixture of tar and pitch in any required proportions, whereby they can be used to greater advantage than heretofore in the various purposes to which these substances are applicable."

To effect this, pulp or the ordinary paper of commerce is used in the proportion of about 1 to 2 per cent. of the tar or mixture; coarser or brown qualities of pulp or paper being preferred. Boiling water or steam is employed to soften it; and it is then submitted to any convenient mode of disintegration, by machinery or hand. The pulp or disintegrated paper is then added to the tar or mixture in about the above-named proportions and heated for several hours, during which time it is frequently stirred; and then, if the tar is to be used for lubricating or certain other purposes, the heated mixture is passed through a strainer. Tar, or a mixture of tar and pitch, treated in this manner is said to become changed in quality and general character, and may be used with advantage in the manufacture of patent fuel, for road making, and for various other purposes.

Charging Inclined Gas-Retorts.—Lampard, W. B., of Stockwell. No. 14,618; Sept. 16, 1890. [6d.]

This invention may be described as follows: An ordinary platform A, mounted upon flanged wheels, runs upon a line of rails B, placed longitudinally in front of the retorts, so that the platform can be brought opposite to any one set. Upon this platform are placed rails C, permitting of transverse motion of a secondary platform D, upon which is erected the charging apparatus. This consists of a set of shoots E, varying in number (there are three shown in the drawing) and in lengths to suit requirements, mounted upon a turntable F. Attached to the



under side of the turntable, and running upon the top of the circular structure or support G, are three or more wheels or rollers H. Suitable wheels or rollers are also placed in or about the position shown on the drawing. The shoots, which are fed from above in the ordinary way, may be either fixed to the turntable F, or attached thereto by forked supports and collars or in any other convenient manner. The turntable F, and consequently the shoots E, are rotated in either direction by the person in charge of the apparatus actuating the handles J on the hand-rail K, which encircles the structure G, and is fixed to the vertical supports carrying the rollers, I. Other means for rotating the shoots by hand, steam, or other power, may however be employed.

Cocks for Mixing Gas and Air.—Goehde, R., of Berlin. No. 16,912; Oct. 23, 1890. [8d.]

This invention relates to cocks by means of which a mixture of gas and air is produced for feeding burners of heating apparatus; and its object is to prevent explosions from occurring in the burner and the parts connected with it when the burner is lit or extinguished.

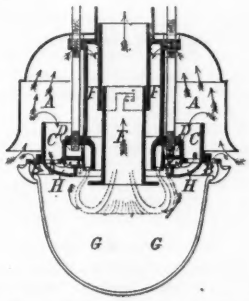
For this purpose there is arranged in the pipe connecting the cock and the burner an aperture for the induction of air; and attached to the plug of the cock is a sluice or slide valve adapted to open and close the aperture as the plug is turned. This sluice or slide valve is put in such position relatively to the plug that, previous to the admission of air, there will pass to the burner a small quantity of gas which is sufficient, after having been lit, to produce a tiny kindling flame. When thereupon the plug and the valve are turned farther, the quantity of gas flowing to the burner increases, while at the same time air is admitted in view of obtaining the mixture of gas and air which is to feed the flame. On turning off the cock, first the supply of the gaseous mixture is stopped, and then the supply of the pure gas. The air-admitting valve may, however, also be attached rotatively to the plug of the cock, and further connection established, by a driving-pin on the plug and shoulders on the valve, so that gas will be admitted first and turned off first. In view of drawing in air by the gas current, the gas is conducted into the pipe connecting the cock and the burner, through a nozzle projecting into the pipe. Moreover, the cock is provided, by preference, with a spring catch, whereby the plug and the valve are arrested during their forward rotation just before air is admitted—this catch requiring to be released by hand before the plug can be further rotated.

Starting Gas-Engines.—Dawes, A., of Kettering. No. 4004; March 6, 1891. [6d.]

In starting gas-engines, as is well known, it is necessary to revolve the fly-wheel or crank-shaft several times before motion is produced by the power within the cylinder; and hitherto it has been usual for a man to perform this initial starting by pulling upon the rim or spokes of the fly-wheel. According to this invention, the necessity for this dangerous practice is obviated, by providing a bush or sleeve adapted to fit the end of the engine crank-shaft, and having a lever arranged in conjunction with it in such a manner that one end of the lever will bite against the crank-shaft or engage with the key-way therein as long as motion is being transmitted to the crank-shaft through the lever, but will release its hold upon the shaft directly the latter commences to move faster than the lever.

Regenerative Gas-Lamps.—Brown, A. O., of Glasgow. No. 8180 May 13, 1891. [6d.]

This invention belongs to that class of regenerative lamps in which the waste gases or products of combustion are drawn through a central opening or chimney.



The air necessary for combustion enters at the lower end of a dome or outer covering, where any sudden and direct currents of cold air are intercepted by a cylindrical partition, which tends to cause the currents of air to ascend and fill the interior of the cover. These currents of cold air become initially heated within the dome, where they become divided; and in this state they are drawn through air ducts—the ascending currents entering near the top of the dome, and the descending ones through ducts or passages formed around a circular horizontal partition plate which divides the lamp into an upper and lower compartment. The descending air, after becoming further heated, is lead into a hot-air chamber, from which it is caused to pass through other ducts or annular passages formed adjacent to, and surrounding the lower interior of the regenerative gas chamber, whence it finally issues and impinges on the outer and under side of the flame. The ascending air, flowing round the outside of the chimney, in its turn passes down to, and feeds the top or inside of the flame. The regenerative gas chamber is annular, and formed partly above and partly below the before-mentioned partition plate; and it surrounds the lower end of the central opening or chimney hereafter referred to. The interior of the regenerative gas chamber is divided by a vertical partition plate, in which are formed (annularly) ducts for breaking up the gas into fine jets suitable for more perfect combustion. The regenerative gas chamber terminates by a downward extension into a burner pierced with holes as is well understood. Gas is supplied to the chamber by two

gas-pipes in the usual manner. The central opening or chimney consists in its lower extremity of a tube or cylinder formed of porcelain or other fire-resisting material, held in position by a bayonet joint, and terminating in a flanged end for giving to the flame the desired shape. The chimney proper consists of an intermediate tube provided near its top with eyes or lugs for clamping the gas-supply pipes; and this again is enclosed by another tube terminating in an ornamental top. The lower part of the lamp is enclosed by a glass globe provided with a hinged joint and lock as is usual for giving egress to the interior.

A, in the engraving, represents the upper, and the B the lower compartments of the lamp, which is fitted with a dome or outer covering with trumpet-shaped mouth for admitting air as indicated by the arrows. C is a baffle-plate or cylindrical partition for checking any sudden and direct egress of cold air. D is the regenerative gas chamber, with two pipes for supplying it with gas screwed into it. One of them terminates in a tube of very small bore, which performs the function of a pilot light when the lamp is not in use. H and H^1 are hot-air chambers with ducts or passages at which the air enters and escapes to the outer and under side of the flame. The hot air essential for feeding the flame at the point of ignition passes downward from the top of the dome, through the opening shown, into the chamber F, and is intensely heated from the chimney by the products of combustion. The gas in the regenerative chamber is divided into thin streams by being made to pass through orifices formed in the vertical partition plate; and it finally issues through jets which constitute the burner of the lamp. E is the lower portable end of the chimney, held *in situ* by a bayonet joint. The waste gases pass away as indicated by the arrows. G is the glass globe constituting the lower compartment, as ordinarily employed.

Gas-Lamp Globes or Chimneys.—Brown, A. O., of Glasgow. No. 8264; May 14, 1891. [6d.]

The object of this invention is to produce one particular form of contracting gas-globe top or cover which will accommodate itself to the variety of shapes and sizes now in use. The patentee claims that he has, as the result of experiments, discovered a means of overcoming the difficulty by a device easy of adjustment to globes of different areas, and with equal results from varying pressures of gas supply.

It is proposed to take two or more strips of copper, brass, or hard metal (preferably steel) in the ends of which holes are punched; and these are connected together at the ends by an eyelet. The other ends terminate with clips, which may be made out of the strips themselves or of separate pieces secured thereto by rivets or studs. These metal strips, the clips of which secure the periphery of the globe at the top, constitute a tripod or bridge. Passing freely through the eyelet is inserted a threaded spindle by which is suspended (by means of a milled nut above the eyelet and another one near the end of the spindle) a shallow inverted cup of opal glass or its equivalent, which performs the twofold function of a damper and reflector. This cover or top is supported by clips secured within the ring of a coronet, which is placed upon the top of the globe as usual. The top terminates at its apex in an opening of suitable diminishing area, to allow the waste gases to pass off—ornamented by a lip bulging outwards. The supports may be made of (say) three or four pieces of non-conducting material placed within the ring of the coronet. These pieces of non-conducting material provide a seat for the cover or top; and the heat thus imparted to the damper or reflector is not transmitted to the coronet and *vice versâ*.

APPLICATIONS FOR LETTERS PATENT.

13,385.—Suiter, A., "Improvements in illuminating vehicles by compressed gas." Aug. 7.

13,420-1-2.—Turner, H. C., "Improvements in gas-stove burners." Aug. 8.

13,431.—Fergusson, J. H., "Improvements in or connected with the manufacture of illuminating gas." Aug. 8.

13,447.—Colson, A., "Improvements in column stills for the distillation of gas liquor and other liquids." Aug. 8.

13,506.—Dvorkovitz, P., "Improvements in the manufacture of illuminating gas." Aug. 10.

13,550.—Wise, W. L., "Improvements in the purification of gas." A communication from Solvay and Co. Aug. 11.

13,780.—Ross, W., jun., "Improved apparatus for controlling the pressure in domestic and other water-supply pipes." Aug. 15.

13,810.—Benier, L., "Improvements in and relating to apparatus for producing gas for gas motor engines and the like." Aug. 15.

Electric Lighting for Manchester.—The arrangements for supplying the public with the electric light are being rapidly pushed forward by the Electric Lighting Committee of the Manchester Corporation. This Committee had a meeting last Thursday, and decided to make certain recommendations to the Gas Committee with reference to the details of the scheme. If the Gas Committee approve the recommendations, then the sanction of the Council will have to be obtained. They recommend, in the first place, that an engineer be appointed to prepare plans and specifications for carrying out the work. The Committee do not as yet intend to interfere at all with the existing plan of street lighting; and the electric supply will be for houses, shops, and public buildings generally.

The Proposed Purchase of the Rhyl Gas-Works by the Improvement Commissioners.—Last Friday week, a special meeting of the Rhyl Improvement Commissioners was held to consider the following recommendations: (1) "That notice to purchase the gas-works be given forthwith to the Gas Company, in accordance with the agreement between the Commissioners and the Company, as confirmed by the Rhyl Gas Act, 1891." (2) "That application be made forthwith to the Local Government Board for sanction to a loan of £38,000 for the purchase of the gas-works, extensions, improvements, and legal expenses, repayable over a period of fifty years, under the provisions of the Rhyl Gas Act, 1891." The adoption of the recommendations having been moved, a discussion followed, in the course of which it was proposed that the matter be adjourned until the first week in October, and this was agreed to.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Assisting Gas Consumers in Checking Consumption.

Sir,—In these days, when the zeal of the gas manager, displayed in his efforts to popularize gas by adopting the system of weekly payments, and by educating the consumer into the mysteries of the gas-meter, has brought the inventive genius, like the Assyrian of old, with his prepayment meter, cash indicator, &c. (though the high price asked for these appliances puts them at any rate beyond the power of small companies to purchase them), and seeing that there really is the need for continual movement in the direction indicated, it may interest managers, especially those of smaller companies, to know of a simple and yet efficient means of performing useful service at a low cost.

For some years past the Napier Gas Company, with which I am connected, have endeavoured, by the introduction of the latest and most approved governor burners, as well as in a literary way through the Press, to teach consumers how to obtain the maximum of light at the minimum of cost, as well as to check the consumption of gas by reading the index of the meter. For this purpose, the backs of all our accounts have upon them a diagram representing the index, with instructions how to read it and calculate the consumption during any period. Concluding, from the opinions expressed in the Journal (which I may say takes the place of companion or gas association to many a colonial gas manager), that the need for further effort was required, I adopted the following plan: On one side of the index of each meter a label is fixed showing the three dials, and giving instructions how to read them. On the opposite side there is another label giving the net cost of each 100 cubic feet of gas up to 1000 feet; thus enabling consumers to check the cost of their lighting or stove gas for any period. The expense of printing these labels amounted to only a few shillings per 1000. The effect has exceeded our anticipations. While fully commending itself on the score of cheapness, its efficiency in our case is shown by the fact that our consumers now read their meters, frequently checking waste; and they are also enabled to make comparison with any other light—thus increasing their confidence in the Company generally.

C. H. Edwards, Manager.

Napier (N.Z.) Gas-Works, July 14, 1891.

The Use of Tar and Ammoniacal Liquor as Manure.

Sir,—I should take it as a favour if any of the readers of the Journal would give their opinion on the value (if any) of tar as a manure. Ours are small private works in the country; and the estate agent has been advised to use the tar and ammoniacal liquor by mixing them with the farmyard manure, and applying them to the land as a compost. I have never heard of tar being employed for this purpose. I should also be glad to be informed as to the best way of applying ammoniacal liquor, first on pasture, and secondly on arable land—whether mixed with farmyard manure or applied by a watering-cart—and the best season of the year for its application.

J. Berry.

Abberley Hall, near Stourport, Aug. 17, 1891.

Gas Exhibition and Cookery Lectures at Blackburn.—Messrs. Unsworth and Richmond, Limited, have just held at Blackburn a successful exhibition of gas appliances, with lectures on cookery by Miss Thwaites. It was opened by Mr. E. W. T. Richmond, who gave an instructive address on "The Use and Abuse of Gas for Domestic Purposes." Last Wednesday evening, a full dinner was cooked with 43 cubic feet of gas; and Mrs. Lewis, a lady of influence in the town, spoke on the advisability of the working classes and mill hands adopting the cheaper gas-stoves, which are let on hire at Blackburn at from 6d. per quarter. Owing to its great success, the exhibition is being continued this week.

The Durham Gas Company and their Workmen.—The Directors of the Durham City Gas Company recently introduced a new agreement with their men as to the conditions of labour. By this the hours of labour were increased, and they were bound to work for at least eight months. This agreement did not meet with approval on the part of the men; and they resolved to come out on strike, unless they could arrive at an arrangement with the Board. On learning of this decision, the Directors last Thursday discharged the men, and paid them a week's wages in lieu of notice; fresh hands being engaged to carry on the work. On Friday night, an open-air meeting of working men was held in the Durham Market Place in connection with the dispute. Mr. Picard, the Organizer of the Gas Workers' Union, was present, and there was a large gathering. Briefly stated, the case put forward on behalf of the men was that a fortnight ago the Directors of the Company intimated that they would require their season hands to sign an agreement binding them to work for not less than eight months, and the summer men not less than twelve months, under altered conditions, which include the working of longer hours without extra pay. The agreement further provided that the men might be discharged at a moment's notice; and that they would be required to carbonize not less than 3 cwt. of coal per man per shift more than has hitherto been done—this also without extra pay. A bonus of 1s. a week was promised, payable at the end of the eight months or twelve months, conditionally on the good conduct of the men. The men, on being apprised of this, demurred to it; and an interview took place between Mr. Watson, their representative, and a representative of the Directors. At that interview, it was mutually agreed that no action should be taken on either side before Saturday. On Thursday morning at 5 o'clock, however, the men were paid a week's wages in lieu of notice, and discharged at once; other men being placed in the works. After Mr. Picard and the Rev. H. E. Fox had addressed the meeting, a resolution was passed condemning the action of the Directors of the Company in discharging their stokers, and approving of the course the men had taken.

LEGAL INTELLIGENCE.

COUNTY OF LONDON ASSESSMENT SESSIONS.

Sessions House, Clerkenwell, E.C.—Saturday, August 1.

(*Before Sir* P. H. EDLIN, Q.C., *Chairman, and a Bench of Magistrates.*)

The Gaslight and Coke Company's Assessment Appeals.

(*Continued from page* 264.)

Mr. *John W. Field* was re-called, and, in reply to Mr. RYDE, said that the item of £61,093 for management included a sum of £29,000 for collectors' commission. Though it was called "commission," the collectors were paid by salary, subject to a small fine if they did not do their work to the satisfaction of the Company. The collectors' salaries commenced, roughly speaking, at £200 a year, and rose by £15 a year until they reached £400.

In answer to further questions put by Mr. CASTLE with reference to the coal contracts, witness said the statement in the annual report, that the high-price contracts had expired, was quite true. The report was issued in July, and the contracts closed on the 30th of June. The Directors had concluded new ones, at a reduction in price, which, adding the usual charges, would work out to something like 14s. 6d. per ton; representing a reduction of 1s. 6d. per ton upon 2,000,000 tons. This would lower the cost of manufacture to the extent of about 1¼d. per 1000 cubic feet. With regard to any possible decrease from the 14s. 6d., it would be pure speculation to say what would be the price of coal in the future. The rise in the price of coal and labour in the twelve months ending June, 1891, would result in an expenditure of £2,814,644, as against £2,239,884 in the account year.

Mr. CASTLE put in a statement giving the weekly quantity of coal delivered, consumed, and in stock at the end of the account year; stating that it showed a continual increase, from about 63,000 tons in July, to as much as 672,000 tons in the following July.

Witness: I should like to point out that in mid-winter our stock had not been maintained at its full quantity. It fell from 141,814 tons on the 19th of December to 76,000 tons on the 9th of June. I may say that 141,814 tons is equal to a little more than a fortnight's consumption. Owing to the failure of the contractors to maintain deliveries, this soon fell to 76,000 tons for the week ending the 9th of January; and on the 16th of January, which is practically mid-winter, we were left with barely one week's stock of coal. It was no fault of the Company's; for we had arranged to have 200,000 tons more coal in stock than we really had. But the contractors' arrears increased from the 19th of January from 161,000 tons to 250,000 tons by the end of the month; and it is to obviate any failure of this kind that we now say it is desirable to largely increase the winter stock.

The SOLICITOR-GENERAL: I notice that the stock became very low on the 6th of March. It is then at its lowest; and it rises again in June and July to upwards of 200,000 tons.

Witness: Yes; the arrears then came in, just when we did not want them. We have been obliged to increase the stock since the list was made out.

Mr. CASTLE: There is one correction in the table put in yesterday, which the Court said was to be taken *de bene esse*. Mr. Field has gone through the figures; and he says that in some respects the table is wrong. For the year 1880 the figures should be 11 and not 10 per cent. In the next line the figures, instead of being £909,545, ought to be £810,637. Then I go down to the year 1884, in which the figures £1,082,960 should be £982,960. In 1888, the £1,035,378 ought to be £1,035,465.

The SOLICITOR-GENERAL: Mr. Field was good enough to hand to me the contracts for coals; and I should like to have these figures before the Court. For every ton, of 20 cwt., delivered into trucks at Beckton, the price is 12s. 6d. for 250,000 tons, and 12s. 3d. for 100,000 tons. I should have thought the smaller amount would have been for the larger quantity.

Witness: I can explain that. The first purchase of 250,000 tons was one of the earlier purchases we made this season. After we had nearly concluded buying, the Marquis of Londonderry's agent came and asked us if we would take a further quantity; and we said we would, at a reduced rate.

The SOLICITOR-GENERAL: That is precisely what I wanted. For the 250,000 tons you were to pay 12s. 6d. per ton, and for the next 100,000 tons 12s. 3d. per ton, delivered into barges in the Victoria Docks; the same quantity delivered into trucks of the North-Western Railway Company in the Poplar Dock, 13s. and 12s. 9d.; delivered into barges in the Regent's Canal Dock, 12s. 7¼d. and 12s. 4½d. free on board—steamers being chartered by the Company.

Witness: The 12s. 6d. is subject to a rebate of 1s., as we were doing the unloading.

The CHAIRMAN: In your opinion, has the abolition of the coal dues profited you or not?

Witness: You see, the abolition of the dues came just at the time that the coal market was very disturbed in the North; and therefore we cannot say whether we did or did not derive any benefit from it. I rather think the coal-owners put the whole of that into their own pockets.

Now that we may take it that the disturbances have ceased, would you say the Company would not profit by their abolition?—The conditions to-day are so altered from what they were two years ago, when the dues were in existence, that I should not like to give an opinion.

Your experience being that of the largest conceivable consumers of coal, you think that the inhabitants of London have not, by the abolition of these dues, profited in any way in the price they would have to pay for the coal?—I do not think they have benefited, or not to the full extent. They may have done so to some degree; but I do not think they have had their share.

The SOLICITOR-GENERAL: As I have the contracts before me, I should like to mention some of the other figures. The next contract is for 200,000 tons of coal into trucks at Beckton Pier and other places, at 12s. 4½d. per ton for Beckton and the Victoria Docks, and 12s. 6d. per ton delivered into barges in the Regent's Canal Dock; that contract being made on the 26th of June. The next is for 200,000 tons; and the prices there are 12s. 3d. at Beckton and the Victoria Docks, and 12s. 4½d. in the Regent's Canal Dock. The next is for 150,000 tons, at 12s. 2d. at Beckton and the Victoria Docks, 12s. 8d. on the railway, and 12s. 3½d. in the Regent's Canal Dock. The next is for 150,000 tons, at 12s. at Beckton and the Victoria Docks, and 12s. 1½d. in the Regent's Canal Dock. The next is 100,000 tons, at 12s. at Beckton and the Victoria Docks, and 12s. 1½d. in the Regent's Canal Dock. The next is for 100,000 tons, at 12s. 3d. at Beckton and the Victoria Docks, and 12s. 4½d. in the Regent's Canal Dock. There are a few more, for smaller quantities; but they are substantially at the same figure.

Witness: As you have not mentioned any names in respect of those contracts, I may say that the prices depend upon what we consider to be the quality of the coal. Thus the lower prices are named for coal which we do not value so highly as the other coal.

Mr. CASTLE: Having heard those figures read, were they before you, and did you consider them, when you said the result was 14s. 6d. per ton on the average?

Witness: Yes; they were the basis of my calculation.

And do you not depart from 14s. 6d. as the total result?—No; considering the addition we have to make for canal and other charges.

Mr. *Harry E. Jones*, M. Inst. C.E., examined by Mr. DANCKWERTS, said he had had large experience in valuing gas-works; having been constantly employed in arbitrations. He had for a considerable time past been engaged in thoroughly investigating the affairs of the appellants, for the purpose of the present proceedings, and had checked his figures over and over again. Having regard to the character of the Company's district, its extent, the number of mains, the population, and so on, their works had to be kept up to the maximum of efficiency; and the Company had heavy statutory obligations. He had valued, on the usual lines, the hereditaments occupied by them; his object being to ascertain what a responsible tenant would be likely to rent the whole concern for from year to year on a continuing tenancy. Lately, as had been stated by Mr. Field, there had been a considerable disturbance in the labour market, which had caused an increase in the cost of the production of gas, and a great uncertainty in procuring a supply of coal. This obtained at the present time; a colliery supplying the Commercial Gas Company, of which he was Manager, having been on strike for two months, and the Company had not any coals from them for this period. The disturbance in the relations of the labour market began, for the purpose of gas manufacture, in June, 1889. A tenant proposing to take the gas-works would have considered these matters. He would have known by experience, in the winter of 1889, that coals had been very scarce and very dear. He (witness) thought that absolutely the carbonizing wages had gone up 50 per cent.; because the hours of labour were shortened 33 per cent., which involved the use of three men to do the work that two had done before. Consequently, there was the pay of the third man in addition to that of the other two; and this made the cost half as much again. In addition to that, owing to the operation of the Union rules, one man did not do so much per hour in eight hours as he did before in twelve. This was not the whole of the effect. The labour was not so good; and the men were not so loyal to their employers as they formerly were. This state of things was prevailing throughout all branches of gas supply; but it was especially in respect to the shipping and unloading of barges, the handling of coals, and the making of gas. There was a similar advance, as had been properly stated by Mr. Field, on the whole of the labour. It was obvious that when the employers had improved the circumstances of the larger class of the labour so very much as to relieve them of 33 per cent. of the duty, it would have been unfair to have left the mechanics and the other men without some amelioration; indeed, the general advance of all the labourers throughout London was thus rendered necessary. The increase of wages took place in the autumn of 1889, when the first change came into operation. But there were further changes; as, for instance, the men requiring to be paid double time between Saturday night and Monday morning. If the gas companies had to work through a period of fog or other pressure, they positively paid five days' wages for the 24 hours. The full effect of these causes had not been felt during the account year ending June, 1890. He had made estimates embracing the calendar year 1890, and had also gone into the question with regard to the year from June, 1890, to June, 1891; and it not only confirmed the opinion he formed in 1889 as to the increased cost, but much more. So that with a larger gross revenue there had been a decreasingly smaller net revenue during these periods. He had heard Mr. Field say that he fixed the price of coal, for the purpose of tenant's capital, at 14s. 6d. per ton; and he thought this was a very proper amount. In June, 1890, they were actually paying 14s. 7d. per ton, Mr. Field stated; though, on the average of the whole year, the price went up to 15s. 2¾d. He considered that something very near the 14s. 6d. must be paid for some years to come. The Commercial Company paid more. They had got over the summit of the inflation; but there would still remain an excess over the normal condition before this advance took place, because there again the question of labour came in. While coal-owners might have to sell their coal cheaply when it hung upon their hands, it was extremely difficult to get wages down. In the whole of his 28 years' experience in conducting gas-works, he had never known wages to be reduced. In the spring of 1890, the price advanced in the North from 5s. 9d. to 10s. 9d. per ton free on board the vessels. In the winter of 1889, the Commercial Company could not get the coal to use. It was 5s. 9d. to 6s. per ton, according to quality; and it went up to 10s. 9d. and 11s. at that time. This had now gone back about 1s. 9d. There was another cause of increased price of production. The supply of cannel coal had decreased, owing to the exhaustion of the fields. This was a source of great difficulty; and it tended to raise the cost of gas manufacture so much that companies were seeking other means of reducing the cost of production. Some of them were trying to use oil; and experiments were being made with water gas. All these facts were perfectly well known to practical people in the first half of 1890; and everybody who had any acquaintance with the necessities of gas making would take them into account.

The CHAIRMAN: You began to distinguish that the value of labour was diminishing, too, notwithstanding the diminution in the number of hours?

Witness: Yes. I establish the proposition that the higher wages we

pay, the worse is the service we get. We were already paying very handsome wages; for very few of our gas makers were receiving much less than £8s. a week. Under the old state of things, the men would always oblige the employers in any way suggested. They would heap the scoops, or do anything with alacrity and willingness; but since that time quite the reverse is the case.

A tabular statement, giving a comparison of the working expenses and receipts for the years ending December, 1889, June, 1890, and December, 1890, was then handed in by witness.

Examination continued: The table showed that the balances agreeing with the Company's published accounts and the net receipts for the calendar year 1889 were £971,888, whereas for the year from July, 1889, to June, 1890, they were £781,615; being a total reduction of about £190,000—close upon 20 per cent., or nearly 3d. per 1000 cubic feet on all the gas sold. Taking the calendar year 1890, it fell to £702,577; making a reduction of £269,311 in the net receipts—nearly 28 per cent., or equal to a value on the gas sold of 4s. 1d. per 1000 cubic feet. The cost of coals increased £124,176 in six months in the year 1890; and in the calendar year ending December, 1890, £359,278. As to wages, in the first year it was £44,989 more than before.

The SOLICITOR-GENERAL: It is not quite reasonable to take the figures in that way, because, although they are higher, the quantity of gas has increased as well.

Witness: No; not in that. The volume of gas sold is shown, and you will see that the quantity sold in the year to June, 1890, is not any larger—in fact, it is much less—than that sold in the year to December, 1889; being 18,069,726,000 cubic feet in the former, and 18,105,229,000 cubic feet in the latter year.

Mr. DANCKWERTS: I see the increase in repairs is very marked. It is £53,000 in 1890, as compared with £19,000?

Witness: Yes; £53,745. Purification is higher, and also distribution.

To sum up, what the tenant would take into account, if he had become the tenant at the beginning of the year 1890, would be, first, that there would be the increased cost of coals?—Yes; at an advance of 5s. per ton.

Next, in connection with the coals, there would be the uncertainty of delivery?—Yes; involving his laying in a larger stock.

Another thing, too, of which Mr. Field told us, is that the colliery-owners insist upon a more level delivery all the year round?—Yes; they practically compel us to receive coals when we do not want them in the summer, and the result is that we have to store them up in the winter and in the summer, as well as keep a large stock to anticipate any possible irregularity. As they cannot ensure their winter deliveries, the stock has to be larger—not only delivered at an earlier period in the year, but a bigger stock kept for safety. This involved an increase in the floating capital; and the coal deteriorated by being stacked and handled, which necessitated a further increased charge. We are obliged to hire land upon which to stack it; and the weather and wet getting to it produces a further deterioration.

That is the first item you take into account. The next is the general unsettlement and increase of wages?—Yes. Then the iron market is up; and all fire-clay goods we employ in the process of gas making—the fire-bricks and retorts—are higher. In the spring of 1890 fire-clay went up 10 per cent.; iron, 30 per cent.; and materials generally became dearer.

What would you, with your knowledge and experience, think would be a fair stock of coals?—This Company ought to have accumulated by September, and maintain it well into January and February, a stock of not less than 450,000 tons of coal; and, of course, a tenant would need to have his money ready for that. Those prices which are considered cheap depend on very prompt payment. The payments are made in most cases fortnightly—I believe more frequently with this Company. In fact, they are all cash prices. That is a great point with the colliery-owners, because it meets the wages at the colliery.

With regard to the condition of the works, which is the fourth matter that the tenant would have to take into account, what do you say about that?—The tenant would have to ascertain what repairs were necessary; to see whether the works had been well repaired previously; and also to bear in mind that he must, in order to keep the works going, have higher-priced labour and dearer materials for their repair. Of course, he would base his calculations upon a continuing tenancy. He could not neglect his repairs one year, without suffering a penalty for it the next, or even in the same year.

With respect to the items charged in wear and tear, are they landlord's or tenant's matters?—Nearly altogether tenant's. The chief part of the expenditure is on the replacement for burnt-out retorts and furnaces, and in the repairs of the tenant's tools and appliances. These do not wear out by weather or by time; but they are destroyed by the high heats employed. This necessitates constant attention to the repairs. A tenant of gas-works cannot leave anything of that sort for his landlord; he has to do it himself, or he will lose his profit as he begins to lose his material.

What you have said with regard to wear and tear applies to steam engines and boilers, and other things of the same kind?—Yes. One set has to be put out of use while the other is being worked. They have to be restored week by week and month by month. They cannot be left for the next tenant; and all this necessitates cash outlay.

With respect to the past history of the works of this Company, they are nearly all new, are they not?—The larger part of the gas-producing works of the present day are comparatively modern. Beckton, which makes nearly half the whole quantity of gas produced by the Company, was commenced on a small scale in 1868 or 1869; and it is still being added to year by year. The Bromley works of the Company, which are the next largest, were started about the same time. Beckton makes 46 million, and Bromley nearly 11 million cubic feet. These are works with regard to which the landlord's repairs have hardly yet been felt, because the plant and the buildings have not at all approached the life which you may assign to them. That would be an increasing annual charge as they age; and provision would have to be made for it.

In addition to that, the competition of American oil has deterred gas managers from undertaking anything that could be conveniently put off in the shape of repairs?—Yes; there has been very severe competition between oil and gas. Although it does not appear in the papers, like the electric light, oil is in reality a far more formidable rival to gas. So much is this the case, that the occupants of some houses in the poorer parts of London burn gas in the front shop, and oil on the rest of the premises. To meet this the Company have taken to letting gas-stoves at a loss, and recouping themselves by the increased make of gas. The increase which has been obtained is, to my mind, largely due to that new development in the use of gas for heating, cooking, and engine purposes.

Do you anticipate that, in the future, provision will have to be made for expenditure for repairs on a larger scale than in the past?—Yes. During the past five or ten years, the repairs have been very light, and the materials very cheap. But they have now returned to something past the normal; and they are likely to be still dearer.

During the last 18 years, what has been the average expenditure on current repairs by the different Gas Companies?—Very close upon 6d. per 1000 cubic feet sold.

What do you anticipate for the future for current repairs?—That they will have to be 5d. per 1000 cubic feet for repairs, and something like 1d. for the renewal fund.

The witness then handed in his valuation for assessment on the Company's accounts for the year to June, 1890; in the first place limiting the assessment to the circumstances of that single year.

Examination continued: I take first the actual receipts and expenditure earned and incurred in the account year, as directed by the Court, and bring out a balance of £781,615. Then I find that the expenditure on wear and tear has been 4·37d. per 1000 feet; and I anticipate 5d. per 1000 feet for the future. I therefore find that 0·63d. more will have to be spent per 1000 cubic feet; and I deduct this from the £781,615 to get at the probable net receipts of the year. This gives a probable net receipt of £734,182 based on the account year. The tenant's share I take at 17½ per cent. on £1,755,374, the details of which I have given. First the value of the meters, stoves, and chattels, £500,000 odd; on the floating capital shown on the balance-sheet, £1,051,000; and coal and residual stock, £203,000. This gives a tenant's share of £307,190; leaving the landlord's gross share, *plus* rates, £426,992. I allow for sinking fund and renewals, at 1·1 per cent., £77,940 on the gas manufacturing works; £2700 on the chemical works; and on insurance, ¼ per cent., £18,787—making a total deduction of £99,427, or giving the landlord's net share, subject to correction for rates, £327,565. Then I take the rates for June, 1890, which were £155,864, and the new ditto, at 5s. 2d. in the pound, on the assessment of £384,182, £99,247, and add the difference of £56,617; making the net rateable value of the whole £384,182. Then I value the indirectly productive works, works and stations, chemical works, unproductive mains, houses, &c., at £5,647,359. Taking 5 per cent. on this, it comes to £282,370, which gives the net for mains, £101,182. I think, however, that this figure should be subject to certain corrections. I consider this is too favourable a year for a quinquennium. If we are to determine this matter on one year—the year 1890—then the figure mentioned should be the rateable value; but if you want to find what would be a fair figure for a quinquennium, then the account must be adjusted as I have done it. First I add to the net balance of £781,615, the 3d. per 1000 cubic feet increase in the price of gas. This amounts to £209,812; making the receipts £991,427. Then I deduct for the correction for wear and tear and increase in carbonizing wages from 4·40d. to 4·56d. per 1000 cubic feet; making 0·16d. increase. Although this is a small fraction, it amounts to a large sum—£12,046. I also deduct the increase in wages for purification. These were according to the account year 0·84d., and they have risen to 1·05d.—a difference of 0·21d., amounting to £15,811. Then there is the extra cost of coals, 11·6d. per ton. That is giving what I believe to be the additional cost throughout the five years, though we have paid a great deal more than that. This brings out £91,295—making a total of £166,585; or corrected net receipts, £824,842. The tenant's capital is larger now, because the stock of coals would, of course, be at an advanced price, owing to the extra figure we have just been discussing. The average stock of coals would be priced at an additional 11d. per ton, which makes a difference of about £28,000 on the tenant's capital. I bring this out, at 17½ per cent., to £312,194, or an extra remuneration of about £5000 to the tenant. I take the other figures the same as before, and bring out the net for mains at £169,883—that is to say, I give the additional 3d., and make the extra allowances to the tenant; and then I get that figure, which would give the landlord 7½ per cent. upon his expenditure; the receipts on mains being £2,559,847, or 6·65 per cent. With regard to the question which has been raised as to the coal dues being abolished, 9d. per ton was taken off first, and then 4d.; but we have received no advantage from that. The price of coals, free on board, was advanced 5s.; but concurrently with this we obtained a rebate of 4d. In the year 1888, 9d. was taken off; and 4d. in 1889. So that, concurrently with the advance of 3s., we had an abatement of 5s. in another quarter. The colliery advanced us 5s., and when we got the coal to London we had an abatement of 4d.; so that the net disadvantage was 4s. 8d. The maximum advance in the coke and breeze receipts was at the rate of about 7½d. per ton. This reduces the 5s. advance to 4s. 0·70d., of which the year to June, 1890, is responsible for 1s. 1·86d.; leaving an advance for the future of 2s. 10·84d., which for the purpose of the tenant's calculations, I take at one-third, or 11·6d. I take that as being the most moderate calculation which a tenant could make. I think about 9s. a ton net, over the whole five years, would be a very fair amount. A ton of coal yields about two-thirds of a ton of coke, of which one-third is required by the process; so that we get only two-thirds of the ton back in weight. We get about 45 per cent. of our weight of coal in the shape of coke; and as coke never advances in the same ratio as coal, and is not so valuable a material, we take a difference of 45 per cent. The 11s. 6d. per ton which I bring out at £91,295 is taken on 1,897,479 tons of coal, the consumption for the account year. I have here the details of the tenant's capital, as per balance-sheet, for the years 1889 and 1890. [Paper handed in.] I have put down the actual number of meters and stoves in 1889 and 1890, and have valued them; also the tools and chattels for the same two years. The latter amounted to £170,801. I have gone through the values attached to them by the different works managers; and I say they are exceedingly moderate and fair prices—greatly below the

replacement cost. The total capital for meters, stoves, tools, and chattels for the year 1889 is £500,292; and for 1890, £530,610. I have taken the lower of these amounts—that for the year 1889—in my account, for the purpose of the valuation. As to the floating capital, I have given the figures £96,378 for 1889., and £114,346 for 1890. I have taken these from the balance-sheets of the Company in the middle of the account year, December, 1889. I have always looked upon the floating capital required to work a gas undertaking, and what a tenant would require, as that which the Company itself has—the money locked up in the buildings, &c. I have preferred this to making estimates, because it is not in the power of one man in a thousand to deal with these figures as Mr. Field has dealt with them. I do not take any credit for rates; but I think, as a matter of fact, they must be involved in the banker's balance of £96,378. I have no separate item. I want to explain, in regard to this, that the figures at the bottom of the first column (December, 1889) are £1,755,374. Mr. Field's evidence yesterday worked out at £1,705,000. I have followed that evidence with great care, and with some information; and the discrepancy of £50,000 arises in this way: Mr. Field would be content if he is allowed £50,000 for rates, with a bank balance of £50,000. I take it that the £50,000 for the rates must be practically in the balance of floating debts, and not in the bankers' balance; and I cannot resist Mr. Field's evidence that my capital must come down by that £50,000. This practically accounts for the difference between us. I take as a floating debt the liability for rates; and then I allow for stocks and stores 100,474 tons of coal, at 12s. per ton. The stores include those of coal, coke, tar, and liquor products, and sundry other things. The total in the published accounts works out at £330,091 for 1889. For the year 1890 I have a very large increase, because the coal stock was improved. The experience of 1889 showed that the Company must get coals in earlier; and they have a better coal stock in 1890. As to the book debts, and so on, the balance due for these, less the amount owing, I bring out at £625,095. This, with the stocks and bankers' balance totals out to £1,051,564, which corresponds with Mr. Field's statement in cross-examination, that the Company had about a million of money floating. In 1889, it was £1,051,564; and in 1890 it had increased by £280,000 odd. To the total floating and working capital for the year 1889 (£1,551,856), I add the extra coal stock required, which I put at £237,372. This is calculated at 450,000 tons, at 13s. 2·78d. per ton, or the price paid in the account year. I deduct the stocks of ammonia and tar. The total of £113,854, Mr. Field explained to me, was abnormal. Although these figures were in the balance-sheet, they having been an abnormal quantity I reduce the amount to £80,000 on his representation. I deduct this £80,000 from the £113,854, in order to arrive at what you consider the normal state of things. This gives a tenant's capital of £1,783,968. I arrive at this by the addition to the account year of £265,966, instead of £237,372 for coals. This is calculated on an average for the five years. I put the extra anticipated cost on to the £237,372, at 11·6d. per ton. The next things to be dealt with are the allowances for sinking funds for renewals. [Particulars of calculations handed in.] The valuations for the gas-works are broken up into five or six different categories. The buildings have a life of 50 years; the tanks have a similar life. That is a heavy tax for the shareholders—the heavier plant. The cast-iron plant has a life of 30 years. Upon the retorts there is no renewal taken, because the tenant must keep putting them in as they are burnt out. The plant is taken at 20 years' life; the gasholders at 25 years. This amounts to £4,686,647; the land, to £285,325—total, £4,971,972. The mains are valued at £1,803,851; houses, £27,400; and chemical works, £135,000. The whole of the renewals up to this point are £6,931,816, excluding such items as services, the chemical works, and the land on which those works are built. I bring out my renewal fund on the gas-works at £77,940; on the chemical works, £2700; and I add ½ per cent. insurance to that.

The insurance gives £18,787; and the £80,640 is the total of the £77,940 and the £2700 added together. The next figures with which we have to deal are the indirectly productive works. I have made a valuation of the works and stations, and bring it out to £4,971,972; chemical works, £142,000; and houses, £99,300—all based on actual valuation. I have taken 5 per cent. on this; and, in my opinion, it is a proper amount. Where the turnover of the whole is as large as this, 5 per cent. is a fair proportion for the indirectly productive works.

Mr. DANCKWERTS suggested that, as the next point upon which he proposed entering—as to the way in which the witness arrived at £434,000 for unproductive mains—would take some time, it would be better to adjourn. It was decided, however, to utilize the time by examination as to the structural valuation of the works, with regard to which the witness put in a table.

Witness explained the purposes for which the various works comprised in the table were used, and said the figures were prepared from his own actual survey.

It was arranged that the witness's figures as to the unproductive mains should be supplied to the respondents before the next sitting of the Court; and the proceedings were adjourned until the following Friday.

Friday, Aug. 7.

At the commencement of the proceedings to-day, it was agreed between the parties that at the close of the sitting the inquiry should be adjourned till after the 15th of October; all action, on the supplemental lists to be stayed in the meantime, without prejudice.

Mr. *Harry E. Jones* was then re-called, and further examined by Mr. DANCKWERTS as to the question of the direct and indirect value of the mains. He said that, in apportioning the net rateable value of the whole between the direct and indirect value of the mains, there were considerable difficulties. It was quite impossible to "ear-mark" any particular main as not contributing in some degree to the supply of the parish wherein it lay. There were various ways of dealing with the question. The one which the previous witness mentioned—simply treating the high-pressure mains as indirectly productive—was clearly not sufficient to do justice; it was a point in which the Company had no interest. When once the net rateable value had been ascertained, the apportionment of it between the various parishes was a matter in which the Company were not at all concerned. If they took so much of the net rateable value more or less of the directly productive mains, it reduced or increased the balance to be divided, under the decision in the Mile End case, upon the receipts of the parish. So long as the system was upon the same basis in every parish, it did not matter one way or other to the Company.

Mr. DANCKWERTS: You have fixed the value of the indirectly-productive mains at £21,704; being 5 per cent. upon the total value of the indirectly-productive mains—£454,087?

Witness: That is so. Perhaps I might explain that if you go upon the high-pressure mains alone, a great parish like St. Pancras is returned without any indirectly-productive mains at all. Surely it is not to be said that a large parish, containing gas-works supplying other parishes, may not have through its limits mains which are contributing to the sale of gas in the adjoining parishes. Therefore, you see, the mere separation of low and high pressure mains would not be equitable.

By high-pressure mains you mean mains which are not tapped?—The previous witness described them as high-pressure mains. They form a kind of girdle round the outside parishes; bringing gas from the works at Beckton and Bromley, which are beyond the Metropolis. The high-pressure mains, where you have the valve-houses in the parish to feed the subsidiary main in that parish, must directly contribute to the receipts for the gas in that parish. Therefore what I have done is to determine it by the volume of gas required to be consumed in the parish, taken in conjunction with the high-pressure mains on the one side, and the large arterial mains of 36 and 48 inches diameter, passing backwards and forwards through those parishes and adjacent ones. Having valued these together, I apportion the amount according to the receipts, by deducting first of all the extent of main which, in my judgment, is required for the satisfaction of the wants of the parish itself; the surplus going as indirect value, as productive generally over the whole rateable value.

In the parishes where there is no gas supplied, you have taken the entire value of the mains as directly productive?—Yes. That happens in a number of parishes lying between Beckton and the City, and the parish of Hackney.

Then in parishes where the gas is supplied, you take only the value of that surplus which you explained as being mains indirectly productive?—Yes; mains in excess of the necessity of the supply of gas in the parish, whether they are high-pressure or low-pressure mains.

Witness produced a plan showing the arterial mains, manufacturing stations, valve-houses, storeage and testing stations, &c., belonging to the Company in the different parishes throughout London.

Examination continued: I have arrived at a figure per million cubic feet of consumption in the parish which I consider as directly productive. I have done so from my own experience and practice in the parishes adjacent to those supplied by the Company—viz., Whitechapel, Bethnal Green, St. George's-in-the-East, and so on. There I find that the value of £19 per million would be required for the wants of the parish itself. That is to say, supposing there were in the parish indirectly-productive mains valued at x, then for every million cubic feet of gas consumed in that parish you must deduct £19 from x. The residue of x, *minus* the 19 y, equals the indirectly-productive mains; y being the number of millions of cubic feet. The arterial mains—the mains which are not tapped for private supply, but which are tapped for the branch into which the gas for the private supply goes—are £19 per million; the balance would be directly producing mains. [Tables showing the value of arterial mains apportioned to the various parishes were handed in.] I have collected all the indirectly-productive mains. Taking, for instance, the parish of Battersea, for every 261 million cubic feet of gas sold, you deduct £19 off the sum of £15,632, the total value. This gives £4959 as being properly attributable to consumption in the parish, and leaves a surplus of £10,673 as being indirectly productive; and £533 represents 5 per cent. on the £10,673. I add all surpluses together, and bring out, for the intra-Metropolitan parishes, £236,914 as the valuation of the indirectly-productive mains. The extra-Metropolitan figures work out to £197,173. Adding the two together, you get £434,087 as being the actual figure of the indirectly-productive mains; and 5 per cent. on this is what I have taken as being the value. If I were to add to the £434,087, the only effect would be to reduce this figure, which I work out as being the rateable value of the mains.

Witness was then cross-examined by the Solicitor-General—this occupying the rest of the day. At the close, the inquiry was adjourned till October, as arranged. Owing to the length of the report, we are compelled to hold it over till next week.

SALFORD POLICE COURT—Friday, Aug. 21.

(*Before Mr.* J. MAKINSON, *Stipendiary, and other Magistrates.*)

The Alleged Attempt to Corrupt the Salford Gas Manager.

To-day, Mr. *Sydney Kershaw*, a coal merchant, carrying on business at Salford, was charged, under the Public Bodies Corrupt Practices Act, 1889, with "unlawfully and illegally corruptly offering to one Sydney Yarrell Shoubridge, an officer and servant of the Council of the Borough of Salford—to wit, the Gas Engineer and Manager of the Gas-Works—a gift as an inducement to, and on account of the said officer doing something in respect of a proposed transaction in which the Council was concerned—to wit, as an inducement to, and on account of the said officer and servant recommending the Council to accept a certain tender for the supply of coal to the said Council for the gas-works, which the said Sydney Kershaw proposed to send in to the Council." There was a very large attendance of the members of the Corporation.

Mr. COTTINGHAM prosecuted; Mr. M'KEAND appeared for the defendant.

Mr. COTTINGHAM said the proceedings had been taken under the Public Bodies Corrupt Practices Act, 1889, the object of which was "the more effectually to provide for the prevention and punishment of bribery and corruption of and by members, officers, or servants of corporations, councils, boards, commissions, or other public bodies." By sub-section 1 of section 1, it was provided as follows: "Every person who shall, by himself or by or in conjunction with any other

person, corruptly solicit or receive for himself or for any other person any gift, loan, fee, reward, or advantage whatever, as an inducement to or reward for, or otherwise on account of any member, officer, or servant of a public body as in this Act defined, doing or forbearing to do anything in respect of any matter or transaction whatsoever, actual or proposed, in which the said public body is concerned, shall be guilty of a misdemeanour." Sub-section 2, which was the one with which they were more especially concerned, provided as follows: "Every person who shall, by himself or by or in conjunction with any other person, corruptly give, promise, or offer any gift, loan, fee, reward, or advantage whatsoever to any person, whether for the benefit of that person or of another person, as an inducement to or reward for, or otherwise on account of any member, officer, or servant of any public body as in this Act defined doing or forbearing to do anything in respect of any matter or transaction whatsoever, actual or proposed, in which such public body as aforesaid is concerned, shall be guilty of a misdemeanour." The defendant was a coal dealer, who had carried on business for a considerable number of years in Manchester. He had been for about 20 years in the coal trade; and in 1889 he tendered for the supply of a large quantity of coal—5000 tons—to be delivered in instalments according to the contract at various times between Aug. 21 and June 30, 1891. The tender was accepted by the Salford Corporation; and the deliveries were made by the defendant, but not, it appeared, according to the dates stipulated. In the month of April last, the contract was running out, and the time was approaching when new tenders would be offered to the Corporation. The defendant at this time called upon Mr. Shoubridge, the Gas Engineer of the Corporation, and told him that he supposed the tender he had made was about to run out, but that he purposed tendering for a very much larger supply of coal and for a quantity of cannel when the time arrived. He said he had been much obliged for the indulgence he had met with from Mr. Shoubridge in not pressing him to deliver when he was unable to do so in consequence of his horses being ill, and that the coal for the supply of which he would tender would be of very good quality, at a price which would benefit the Corporation. He therefore trusted the contract would be placed with him. The answer of Mr. Shoubridge was that which would be expected from any respectable gentleman in his position. He said: "The contracts are about to expire; and if your coal is good, and is at a reasonable price, you stand a good chance of placing it." Defendant then thanked him for his courtesy; and having once more expressed his intention of tendering again, he handed to Mr. Shoubridge an envelope, remarking that he hoped he would accept it as a small present in return for his kindness. Mr. Shoubridge did not even touch it. He said that he had merely done his duty, and could not accept anything of the kind. Thereupon the envelope was taken back—really, it had not been taken up, because Mr. Shoubridge would tell them that he never touched it. Mr. Shoubridge having refused the envelope with a certain amount of surprise and indignation, defendant said: "I shall tender for an increased quantity of coal; and I hope I shall succeed in getting it." The contract was accordingly sent in on May 25; and in the meantime Mr. Shoubridge had very properly informed the Gas Committee of the Corporation of what had passed between him and the defendent, and correspondence ensued. In the first place, the defendent was informed that the charge had been made that he had attempted to bribe Mr. Shoubridge. They found defendent writing to Mr. J. S. Phillips on June 18, 1891 as follows: "Dear Sir,—I am grieved indeed to learn of the grave charge the Gas Engineer has brought against me. In justice to myself, I beg of you to grant me a hearing before your Committee, when I hope to be able to explain the matter somewhat." He did not go before the Committee. He was informed that whatever he had to say he must put into writing. Accordingly, on the 25th of June, he wrote as follows:—

To the Salford Corporation Gas Committee. *Salford, June 25, 1891.*

Gentlemen,—I thank you very much for your kindness in allowing me the privilege of making a full explanation respecting the charge referred to in my letter to Mr. Phillips on the 18th inst. Last Tuesday week I saw Mr. Rudman, and asked him when the coal contracts were likely to be decided. He, in a very pained manner, answered me by saying that I had attempted to bribe the Gas Engineer by offering him something in an envelope. I grieve to say I did offer the envelope; but certainly not in the nature of a bribe. I will now give you my reasons for so doing. During the last nine months of the present contract (through circumstances over which I had no control) I have been compelled to request indulgence from Mr. Shoubridge, which he very kindly granted. (1) On Oct. 29, I wrote Mr. Shoubridge requesting to curtail deliveries for a few weeks, as there was something the matter with the roads down the pit. I enclose his reply. (2) In December all my horses were laid up with "pink eye;" and I had again to claim his indulgence, which was readily granted. Several times afterwards during the late severe winter (through the fog and non-delivery by the railway company), I had to request indulgence from delivery, which was always granted. Of course, I made up the back quantity as soon as possible. When thinking of the above, I felt an irresistible impulse to show my appreciation of Mr. Shoubridge's kindness in some way; and I, unfortunately, offered him a present enclosed in an envelope, which he very properly refused. When I did that, I had no thought whatever of future contracts. It was a stupid, foolish, and very wrong thing to do. I apologize to you gentlemen, and to Mr. Shoubridge, for having offered him this insult. It is now close upon 20 years since I came to Salford (not knowing a single person) to open out a trade for a firm of colliery proprietors, who, at the expiration of their leases, turned the business over to me. I have worked hard to gain a good connection, and the confidence of a large number of colliery proprietors; and, save and except a turkey at Christmas or a New Year's gift to the men, this is the first time I have offered anything of the kind. It has been a life-long lesson to me, I can assure you. Taking all the above in consideration, I appeal to you, gentlemen, to forgive this one act of indiscretion, and not to blight my name and all I have been working hard for during the last 20 years by placing me on the Committee's black books. (Signed) SYDNEY KERSHAW.

The first thing to be said was that the Corporation did not know, and probably never would know, what the envelope contained, but had it been, as was suggested, not of the nature of a bribe, but merely an acknowledgment for the indulgence, why did not the defendant state what it was—whether money, tickets for the theatre, or his photograph? One could hardly believe that if it was an acknowledgment of the kindness that Mr. Shoubridge had shown him, he would have insulted that gentleman by offering him a paltry sum of money. The defendant entered into a defence; and yet he kept to himself persistently the nature of the present. He admitted that it was a present, and that it was most improper to offer it; but he said it was not in the nature of a bribe. The Magistrate would have to take into consideration the circumstances of the case. After these events, defendant tendered for the contract. It was refused; and proceedings were taken against him. The Attorney-General had been communicated with; his fiat had been procured; and they were there to ask the Bench to commit the case to the proper tribunal. It was needless to dwell upon its importance. It was most fortunate for the Corporation that their servant Mr. Shoubridge—was incorruptible. Had he, in a moment of weakness or dishonesty, accepted the present, it might have opened the door to a repetition of those acts of bribery and corruption which had made the borough so unenviably notorious in the last few years. He would prove the facts he had stated; and if there was no answer to them to the satisfaction of the Magistrates, they would do their duty to the public by sending the case to a jury.

The following evidence was then given:—

Mr. *A. Holmes*, Deputy Town Clerk of Salford, produced the fiat of the Attorney-General for the present prosecution, and other formal documents. He also proved the appointment of Mr. Shoubridge as Gas Engineer.

Mr. *S. Y. Shoubridge* confirmed the statements made in Mr. Cottingham's opening remarks. He stated that on the envelope being offered to him, he said he could not accept anything. Defendant then said: "I hope I have not offended you, and that you do not think I am offering you a bribe, for I had no such intention. I merely wished to show my appreciation of your courtesy to me in carrying out the contract." Witness replied that, whatever might be his reason for making the offer, he (witness) could accept nothing. The defendant then rose to go; and again said he was very sorry he had offended witness. He added that he would send in a tender for coal and cannel, and that he hoped he would get a contract. The defendant then left.

Mr. COTTINGHAM: Had you shown him more courtesy and kindness than you had shown any other person who happened to be in the same position?

Witness: No, I think not. He had had to ask me on three or four occasions not to press delivery, because of difficulties at the pits, and because a number of his horses were laid up with a disease called "pink-eye."

Was this more than it was your duty to do, or more than you would have done for any other contractor?—No.

In further examination, witness said the annual advertisements for coal were issued on May 14 last; and the defendant sent in a tender dated May 25. The tenders were laid before the Gas Committee on June 10; and he then told the Deputy-Chairman what had passed between himself and the defendant. He had previously mentioned the matter to the Chairman of the Committee (Mr. Holland).

Mr. M'KEAND: Before I attempt to cross-examine this gentleman, I should like to take the opinion of the Bench on the matter. These facts are practically undisputed; and I do not make a single suggestion against Mr. Shoubridge. It is obvious, from the letter which Mr. Kershaw wrote, that something (whatever that something was) was offered by the defendant to Mr. Shoubridge—offered, as Mr. Cottingham alleges, by way of a bribe, but, as we say, as a present to this gentleman. Of course, you can see the defence that will be set up. If you are of opinion that this was merely a present that was offered as a recognition of the indulgence Mr. Shoubridge had shown the defendant, I submit that it does not come within the purview of the Act of Parliament. If it was intended as a bribe for the purpose of obtaining further contracts, it clearly does come within the Act. I should like to take your opinion on this point. If you tell me it is a matter you cannot decide here, and that you feel it is your duty to commit this gentleman for trial, I shall say no more, for very obvious reasons, but shall reserve my defence.

The STIPENDIARY said he had no doubt there was a *primâ facie* case.

Mr. M'KEAND said Mr. Kershaw was anxious to have the case investigated at the earliest opportunity; and he would ask the Bench to commit the defendant to either the Assizes or the Sessions—whichever would be held first. In the meantime, it was only just to Mr. Kershaw to say that he had a full answer to the charge, and courted the inquiry with every confidence. Subsequently, Mr. M'Keand said that, on consideration, he preferred the case should be heard at the Assizes.

The STIPENDIARY said the case would be sent to the Sessions for trial; and it would be open to Mr. M'Keand to move for a writ of *certiorari* to have it remitted to the Assizes.

The defendant was thereupon committed for trial at the Sessions; bail being allowed—himself in £250 and a surety in £500.

Poisoned by an Escape of Gas.—Last Saturday week, Mr. A. C. Langham held an inquest at St. Bartholomew's Hospital touching the death of Thomas Shortlands, aged 65 years, a poulterer, residing at 57, Great Sutton Street, Clerkenwell, who was poisoned by an escape of gas on the previous Sunday morning. Mrs. Jacobs, wife of the landlord of the house, deposed that the deceased and his wife occupied the second floor. They seemed quite well when she saw them on the Saturday night. At about one o'clock on Sunday afternoon, as she did not hear them stirring, she went up to their room, and found the deceased in bed, apparently asleep, while his wife was lying on the floor. Mrs. Shortlands told her that she had fallen out of bed in the night. There was a very strong smell of gas in the room, and witness wanted to leave the door open and to open the windows; but Mrs. Shortlands said she would sooner have them shut. On Monday morning, at about ten o'clock, she went up again to the room, and saw the couple still in bed. She tried to awaken them, but could not do so, and she then sent for a doctor. Dr. Cliff came, and pronounced the woman dead, and the man dying, and the latter was removed to the hospital. The house physician having deposed that the deceased was in a comatose condition when admitted, and died on the following day, death being due to gas poisoning, the jury returned a verdict of "Accidental death through gas poisoning." A similar verdict was returned in the case of the wife on the previous day.

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

Recent Appeals to the Chief Gas Examiner.

(*Continued from p.* 312.)

In the matter of the appeals of the COMMERCIAL GAS COMPANY *against the reports of the Gas Examiner at the Wellclose Square testing-station, showing defective illuminating power in the gas supplied by the Company on Jan. 26, and Feb.* 4, 9, *and* 17, 1891.

Each of these appeals was lodged within seven days after the days on which the respective reports were made. At the hearing which I gave to the parties in these appeals, Mr. H. E. Jones appeared for the Company; Mr. Dibdin for the County Council.

It was stated, on behalf of the Company, that they had no reason to doubt the correctness of the tests, although there were considerable variations in the candles. That on each of the days of the defective illuminating power the gas was of good quality on leaving their works. It was urged that on its way to the testing-place the gas must have undergone some severe process of deterioration, probably by the deposition of naphthalene. It was stated that the main passes under the water of a dock, and may probably have been there exposed to a low temperature.

The Company was not able to obtain evidence of the circumstance to which the deficient illuminating power was due.

I consider that the Gas Examiner's report must be accepted.

(Signed)

May 27, 1891. ALEX. W. WILLIAMSON, Chief Gas Examiner.

In the matter of the appeals of the SOUTH METROPOLITAN GAS COMPANY *against the report of deficient illuminating power at the Stoney Lane testing-place on March* 23, *and the report of deficient illuminating power at the Blackfriars Road testing-place on April* 10, 1891.

Each of these appeals was lodged within seven days after the day on which the report was made. At the hearing which was appointed for these appeals, Mr. Dibdin appeared for the County Council. The Company sent a written statement to the effect that they would not appear, and that it had been their intention to withdraw the appeals.

The reports of deficient illuminating power must be accepted.

(Signed)

June 6, 1891. ALEX. W. WILLIAMSON, Chief Gas Examiner.

In the matter of the appeal of THE GASLIGHT AND COKE COMPANY *against the report of the Gas Examiner at the Dorset Buildings testing-place showing deficient illuminating power in the gas delivered by the Company on June* 8, 1891.

The appeal was lodged within seven days after the day on which the report was made. At the hearing which I gave to the parties, Mr. Trewby appeared for the Company; Mr. Heisch appeared for the Corporation.

The Company contended that the test reported by the Gas Examiner was not a statutory test, inasmuch as the Gas Examiner who made it failed in one particular to conform to the instructions of the Gas Referees.

It was admitted by the Gas Examiner that his readings of the thermometer and of the barometer, made at the time of each testing, were recorded on a loose piece of paper, instead of being entered in the book in which the other particulars of the testing were entered.

The Gas Referees lay down that "the Gas Examiner shall enter in his book the particulars of every testing of illuminating power made by him at the testing-places during or immediately after such testing." The temperature and pressure at which the gas is measured off for each testing are "particulars" of such testing, and ought accordingly to have been entered in the Gas Examiner's book during or immediately after such testing.

I consider that the deviation by the Gas Examiner in this particular from the precise procedure laid down by the Referees deprives this test of its statutory authority.

The report of the Gas Examiner must accordingly be disallowed.

(Signed)

July 3, 1891. ALEX. W. WILLIAMSON, Chief Gas Examiner.

SOUTH METROPOLITAN GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held at the Bridge House Hotel, London Bridge, last Wednesday—Mr. GEORGE LIVESEY in the chair.

The SECRETARY (Mr. Frank Bush) having read the notice convening the meeting, and also the minutes of the previous meeting, the report of the Directors, which was given in the JOURNAL for the 11th inst. (the accounts appearing last week) was taken as read.

The CHAIRMAN proposed—"That the report and accounts now presented be received and adopted, and the report entered on the minutes." He said he was not going to take at all a despondent view of matters, because there was nothing to be despondent about. There had been one or two gas companies' meetings at which the Chairmen had expressed themselves in a lugubrious sort of way; but the proprietors would not find any such feeling prevailing at that meeting on the part of their Board. The main item which accounted for the deficiency of revenue shown in the report was the increase in the price of coal. If he took the figures of June, 1890, and June, 1891, for their coal, there would be found a difference of £74,000—that was, they had paid for coal about £74,000 more in the June half of 1891 than they paid in the same period of 1890; but they had bought a larger quantity. Therefore it was not fair to take the matter quite in that way; and so he would take it at the price per ton. They had paid 2s. 7¾d. per ton more for their coal in the past half year than they paid in the June half of 1890; and this, on the quantity they had used, amounted to £46,000. Therefore if coal had been at the same price as it was a year ago, they would have been £46,000 better off in their revenue. But this was all he had to say in disparagement of the coal question. All the rest was of an opposite character. In the first place, he must acknowledge that the quality of the coal delivered by their contractors had been maintained; and as to the supplies with which they had been bound by their contracts to furnish the Company during the severe frost of last winter—during December and January—no fault whatever could be found with the way in which they had carried out their obligations. He might state that at the beginning of the frost the Company had a stock of 58,000 tons of coal; and after seven weeks' struggling through it, on the 17th of January they had 35,000 tons on hand, or close upon two weeks' supply. They thus lost 23,000 tons of their stock in the seven weeks; but in the same period they received 126,000 tons, and used 149,000 tons—thus accounting for the deficiency of 23,000 tons. They had, however, in this time become accustomed to the frost, and had found out how to deal with it. Their Manager at the Old Kent Road, assisted by the Canal Company's men, had mastered the ice question; and he (the Chairman) believed that if the frost had lasted for three months, the Company would have gone on in the same way as they had done all through January. He ought to say something about their contractors in the North, and of the manner in which they had acted. They had not only kept up their supplies, but there was one who made a contract with the Company last year for a period, who, finding the price of coal had gone down more than he had expected, said that for the remainder of the contract he would reduce the price by 1s. per ton. This incident would give the proprietors an idea of the way in which the Directors carried on business with their contractors. The gentleman in question said to them: "You have always treated us fairly; and I do not like to take this high price from you, considering the way you have dealt with us." Then, as to the Company's agent in the North, the regularity of the deliveries they had received was, no doubt, due to a great extent to the exertions of Mr. Harrison, their Newcastle agent, who had occupied this position since 1840, and was still doing very good work for them. Something might be said as to the advantage of long or short contracts. He looked through the figures a few days ago, and found that going over a period of ten years, and comparing their prices with those of other companies, they had paid during this time an average of 1s. 6d. per ton less than other companies who had been in the habit of entering into contracts for periods of three years. Their own principle was to make a contract for twelve months—to get their coal at the marker price of the day, as nearly as possible; and he was convinced, by the experience they had had, that they did better for themselves, and worked more satisfactorily with their contractors, than if they made long contracts, which would sometimes go against the latter and sometimes against themselves. He had told the proprietors that there had been a loss of £46,000 in their coal by the higher price which they had paid for it; but he was now coming to the other side of the question. Although there had been this loss, it was the only item on which they had been losers. On going through the other items on the expenditure side of the account, he found, almost without exception, that they were smaller than they were a year ago. The amount of the saving on the other items represented 2s. a ton on the aggregate. As he had said, they had lost 2s. 7¾d. per ton on their coal, and they had paid 8¼d. per ton more for their profit sharing, ¾d. per ton more for law, and ¼d. per ton more for bad debts; making altogether 3s. 5d. per ton against the Company. On the other side, however, they had 2s. a ton in their favour; so that, instead of being short by £60,000, the 2s. a ton brought back £36,000 by improved working. Consequently, the loss, compared with the working of last year, had been only £24,000. They had, moreover, sold more gas per ton than in the corresponding half of 1890, and had obtained what was equal to 4d. per ton on this item; and they had also received a little more from the products. They had thus derived a gain of £8000; further reducing the loss from £60,000 to £16,000 compared with last year, when, they must remember, there was also a heavy deficiency. The price of coal in the past half year had been 4s. a ton more than in the corresponding period two years ago. He did not want to conceal anything from the proprietors. They had done fairly with the coke; but with respect to tar they had not done so well. They had only received what was equal to 1s. 5d. per ton of coal for their tar. They had, however, done their best. They made arrangements with contractors on a sliding scale principle. But this had not answered; and now they had gone back to the old system of making a definite contract from year to year, at so much per gallon. This price would have given them last half year equal to 3d. per ton of coal more for their tar. When the Directors said in their report that there was a reduction in the value of coke, they were referring to the six months ending in December. Compared with the June half of last year, coke was about the same; but compared with the December half, there was a falling off of a few pence per ton. He now came to the question of gas testing. He thought the report dealt with this clearly; but he might give an illustration. The London County Council were always changing their testers. Medical students just out of their time took up the appointment of gas testers, whereby they received about £100 a year. A great many of these men had not had any experience whatever in testing gas; and they gained their experience at the Company's expense. At one of their stations they had had for some years an experienced analytical chemist; but after a time it did not answer this gentleman's purpose to act as gas tester. He was an able, capable man—a man of position—and he had, they believed, made his tests fairly and honestly. He (the Chairman) did not say that the other testers did not make theirs honestly; but they did not make them fairly. A young man was appointed to take the place of the gentleman referred to; and, do what they would, they could not then supply gas of the proper quality at this particular station. They used more cannel; they used oil; they raised the standard from 16½ to 18 candles. Nevertheless they could not, according to this young man, get 16-candle gas at this testing-place. It had cost them 2d. per 1000 cubic feet more to increase the quality of gas at this station; and it would have amounted to a loss of £52,000 a year if they had done the same at all their stations. The consumers would have had to pay this amount, and they would have derived no benefit whatever from it. An impression prevailed

that if gas companies could be "squeezed," it would come out of their pockets; but this was not the case. The interests of the companies and of the consumers were identical; and anything that would act upon the former would re-act upon the latter sooner or later. The Directors addressed a letter to the London County Council, and had a most satisfactory interview with the Chairman of the Sanitary Purposes Committee; and they were also honoured by the presence of the Chairman and the Vice-Chairman of the Council. He was satisfied, from what they heard from these gentlemen, that they desired to do what was right and fair to the Gas Companies and just to the consumers. With reference to the paragraph in the report alluding to the deficiency of revenue, there was a falling off on revenue account of £59,649. The deficiency on the last two years, however, had been about £300,000; and the proprietors would ask where this had come from. Well, it had come from the reserve fund to the extent of £200,000; from the insurance fund to the extent of £30,000; an undivided balance of £27,000 which they had carried forward had been absorbed; and the shareholders had given up £50,000 of dividend in the two years. According to the price at which the Company had sold their gas, the proprietors were entitled to £50,000 more dividend than they had received. But, leaving this out, the deficiency in the last two years—including the £60,000 referred to in the present half year—amounted to £257,000; and this had been met by the reserves which the Company had in hand. He wished at this point to make a remark about reserve funds. When gas companies went to Parliament, there was generally a determined attack made on their reserve funds. The authorities seemed to think that reserves were greatly to the benefit of the companies; and that the lower the point to which they could reduce the funds which the companies could hold, the better it would be for the consumers. In one sense, perhaps, they might be right. They thought the reserve fund was built up out of profits which would otherwise go in reduction of the price of gas. It should, however, be understood that the reserves which the companies held had grown in the course of 25 years—in their own case the period was 30 years. A very large proportion of the amount was the accumulation of interest—probably a larger proportion than the profits. What would have been the effect had their own Company had no reserve fund? Two years ago they must have raised the price of gas 5d. per 1000 cubic feet. They could not have gone on incurring a loss. By raising the price by 5d., they would have obtained from the public the total amount of the reserves which had been expended in carrying on their business. But with this increase of 5d. they must have reduced their dividend to 12½ per cent. In the two years the shareholders would thus have had £40,000 less dividend than they had received, while the public would have paid £250,000 more for their gas. The reason they had not been paying this additional price was solely because the Company had had a good reserve fund. As far as the shareholders were concerned, he did not care at all about the matter. The worst that would have happened to them would have been a reduction of ½ per cent. in their dividend. But it was an advantage to the Company to have a reserve fund, because it enabled them to equalize their price, and to keep the dividend steady. This brought him to the subject of the increase in the price which they proposed to charge from Michaelmas next. He had met several shareholders since the report was sent out, and they had expressed satisfaction at the paragraph in which the announcement of an increase was made. One shareholder had said he was very glad that the Directors had advanced the price; to which he had himself replied that he was very sorry. Another shareholder said: "I am glad you have raised the price of the gas. But you have done a right thing at the wrong time. You ought to have raised it two years ago." He (the Chairman) disputed this. He contended that to have raised the price two years ago would have been a great mistake. The only argument which had been used in favour of increasing the price two years ago was this: It was said, "If you had raised the price immediately after the great increase in the cost of labour and of coal, the public would have expected it, and would have taken it as a matter of course. Now coal is going down somewhat, and the public will be far less pleased with you than if you had raised the price two years ago." He disputed this altogether. In the first place, he objected to the argument, which was based on the ignorance of the public; and it was assumed that the Company might take advantage of this ignorance. Having funds in hand to enable them to carry on their business, it was assumed simply because of the accidental circumstance of an advance in the price of coal, which had its effect on the public mind, that the Company ought to have availed themselves of this and to have raised the price of gas. He would rather let the public see that they continued to act fairly towards them. A day or two since he met a gentleman, who was connected with one of the leading newspapers, who said to him about this matter: "The public know Mr. Livesey, that you will never raise your price until it is absolutely necessary to do so." This, he contended, was the right and proper principle; and it was the principle that was most in the interests of the Company. If they were to raise the price whenever there was the smallest excuse for it, they would be playing into the hands of their enemies; whereas if they showed the public that they were willing to use up their reserves and to forego a considerable amount of dividend (the £50,000 he had mentioned) rather than raise the price of gas, they would maintain the position they held in the public estimation—a position of which they were very proud. They felt that the public regarded them as honest traders, who would deal fairly by them; and they contended that, by acting as they had, they had done their best to maintain this character. It might be asked why they had delayed raising the price. His reply was, "Simply because it had not been necessary to raise it before; and they hoped that they might have tided over the period of high-priced coal without raising the price at all." The price of coal had been kept up longer, and at a higher point, than had been expected. It had been kept up, he believed, partly by the excessively cold winter increasing the demand for gas coal, and partly by the gas companies—in consequence of labour troubles and difficulties—laying in much larger stocks in the summer time. This had led the coal-owners to believe that there was a much greater demand for coal than was the case. In fact, to take the case of the coal-owner who came to them last winter, that gentleman said: "Last summer we expected that coal was going to rise, from the great demand in the summer." This was caused by the Gas Companies laying in large stocks, as he (the Chairman) knew, though this gentleman did not. "From the demand in the summer," he said, "we expected a great increase; but, notwithstanding the severity of the winter, the demand was not so great as we anticipated, even if it had been an ordinary winter." This had kept up the price of coal. They had hoped it would have gone down some months, or even a year ago. There was one thing he would like to say in connection with this matter. He had recently seen a statement that the coal miners had received in the last year or two something like £9,000,000 more in wages; and it was argued, from their point of view, that this was a very grand thing for them. But this £9,000,000 which had been paid to the coal miners for wages had not increased the wealth of the country by that amount; it had been taken out of the hands of the general community. For instance, it had reduced this Company's profits, taken from their reserve funds, and compelled them to increase the price of gas. Everyone who burned coal, or used gas, whether for manufacturing or for domestic purposes, had had to pay a part of the £9,000,000 which the miners had received. It might have benefited the miners; but, instead of being a benefit to the country, it had acted detrimentally to everyone else. He was not sure, however, that it had benefited the miners. An official of a Trade Union had called upon him that day—not in connection with the gas-works at all, but connected with the dockers—to whom he remarked: "A great deal is said about their increased pay and their longer leisure tending to the improvement of the workmen's minds." This observation was met with an expression of contempt by the person in question, who replied: "Improvement of their minds, indeed! In the public-house, with pots of beer before them; that is how they are improving their minds." He might tell the proprietors—from his own experience, unfortunately—that the increased wages and longer leisure had tended, in a large number of cases, to the workmen's detriment. Men had said to him that they were worse off now than they were before. They had told him that they could not sit at home all the hours they were not at work, but that they must go about the streets; and in this way they spent their money. It was the fact that the drink bill of 1890 was £10,000,000 or £12,000,000 in excess of that of 1889. In dealing with the business, the Directors always remembered that the shareholders had duties as well as rights. They had a valuable monopoly—they had great privileges; but this involved the duty to serve the public to the best of their ability, and in the fairest possible manner (cheers). He was very glad indeed to find the shareholders respond to this view. The bright side of their case was that they had had a highly satisfactory increase of business. They could not compare it with the June half of last year, because they then had the strike and all the difficulties connected with it, which reduced the consumption; but comparing it with two years ago—with the first half of 1889—they had had an increase of 15 per cent. in their business. If they had been able to supply the gas that was required in 1890, they would have had in the first half of that year, an increase of from 3 to 4 per cent.; so this left them with an increase of about 11 per cent. in the present half year over the normal increase of 1890. This 11 per cent. was made up to a considerable extent by the cold weather; but, happily, not entirely, nor nearly so, by this circumstance. They had had an increase of 7 or 8 per cent. all through after the cold weather ceased; and this he considered was one of the satisfactory features of their business. Although they had lost money, they had not lost business—they had rather gained it; and another gratifying thing was that they retained control of it. They dealt fairly with their men, who had no desire or wish to dictate to them how to conduct their affairs. The men never now threw down their tools and went to the Union to ask what they were to do. They felt that if they had a grievance, they could go to their superior officers, and even to the Board, and make it known; but the Directors never received any complaint. The officers acted fairly, justly, and kindly towards the workmen; and the best feeling existed between them. With regard to their officers he could not speak too highly. They worked as one man for the good of the Company. There was no jealousy or bickering; each and all were doing their best, one with the other, and in loyal co-operation with the Directors, to benefit and improve the position of the undertaking. He had one word to say with reference to the consumers becoming shareholders. The Company had thus tapped a new source of capital, so to speak. He thought that far too much of the capital of gas companies had been confined to big capitalists and to Stock Exchange people. The Directors had tried a different plan. They had offered stock in small amounts to their workmen and the consumers. According to their regulations, stock might be transferred in sums of not less than £5 or multiples of £5. They had sent a circular to the consumers, intimating that they had certain stock to dispose of; and before they had distributed all the circulars the whole of the stock had been taken up, and they had had to disappoint a great many applicants. At any rate, the consumers generally had, within the last twelve months, invested, in small amounts, £107,000 in the Company; and the workmen had invested £2200 in the stock. He believed that by extending their basis, by making the consumers and their workpeople partners in the business—by giving smaller people an opportunity of investing their savings in a business that would give them a safe 5 per cent.—they were not only benefiting the Company, but the community at large. He met a gentleman the other day, who told him that he had been talking recently to one of the Trades Union leaders, to whom he said: "Do you know Mr. Livesey?" The reply was in the negative. This gentleman then said: "If you knew him you would not think so badly of him as you do." To this the reply was made: "Oh, he is a capitalist, and *therefore* an enemy." Of course, said my friend there was no argument to a remark like this. If, however, they could spread their capital more—if, besides having what was called the "bloated capitalist," they could include the small trader and the working man, and give him the opportunity of investing his savings in a profitable concern—he thought they were doing good to the community as well as to themselves and to the Company. They intended to give every facility for doing so. A small capitalist said: "If I buy £5 of your stock, how can I sell it? I had better put the money in the Post Office, and get 2½ per

cent. for it, and be able to draw it out at any time without trouble or expense." The Directors saw that one could not go to the Stock Exchange to dispose of such an amount. They had therefore made arrangements to buy or sell small quantities of stock at any time at market prices, on application being made to the Secretary. He supposed that it would not offend the Stock Exchange, but they would not charge any commission. He wished this to be known to the small shareholders. A great deal of objection had been raised on the score of the 13 per cent. dividend; but this was not the actual dividend paid. He could only repeat what he had said before. In 1876, Sir Thomas Farrer, who was then Permanent Secretary of the Board of Trade, said it would never do to let gas companies go on piling up capital at high rates of interest, for which the public would have to pay either in the shape of interest or, if the time came to buy the properties, in the shape of an exorbitant purchase price. Therefore, whatever might have been the case with past capital, which had taken all the risks and losses attending the establishment of the gas industry, all capital issued in future by gas companies should be a charge of about 5 per cent. to the public. The Board of Trade got Parliament to introduce the auction clauses; and since 1876 all capital which they had had to issue had been sold by auction or tender at prices which only realized a dividend of 5 per cent. For instance, those of their consumers who had invested £107,000 only got about £5700 a year on the amount. The quantity of stock they had purchased was only £44,400, on which 13 per cent. was paid; and for their £5 of stock they had paid £12 2s. So that, when people complained of the high dividend which the Company paid, it ought to be made known to them that they did not pay a dividend of 13 per cent. on any capital that had been issued since 1876, the return on which was only about 5 per cent. With reference to the capital that was issued before 1876, the stock had been sold by the early holders, and people had bought it at high premiums. He believed that the position of their Company was as good as ever it was; and he thought the consumers would feel satisfied that they had not raised the price unnecessarily, and that they would reduce it as soon as they possibly could. The way in which the shareholders had received the statements from the chair, when they had been called upon to take smaller dividends than they had been entitled to, reflected great credit upon them.

Mr. Robert Morton, in seconding the motion, said that the Board considered it wise to keep the price of gas as low as possible; and they had therefore felt great reluctance in having to notify an advance. The only other point he desired to refer to in the Chairman's statement was with regard to the happy relations now existing between the workmen and the officers. The position of the officers now was "a bed of roses" compared with what it was two years ago; and the Directors hoped that those relations would continue.

Mr. W. Hall expressed a hope that the London County Council would be brought to their senses in regard to the matter alluded to by the Chairman. It must be to the interest of gas companies to keep down the price of their commodity, having regard to the electric light. He had been very pleased to hear the remarks which had been made as to making small allotments of stock to their consumers; and he regarded this as a very wise proceeding.

Mr. Austin agreed with the capital being held by shareholders, the consumers, and the workpeople. With reference to the price of coal, the coal-owners had raised the rates far more in proportion to the increase which they had had to pay to their miners in consequence of the strike.

Mr. Coppin observed that the gas companies by the sliding-scale were under a stringent Act of Parliament, which provided that for every penny per thousand by which the companies reduced the price to their consumers, the shareholders should be entitled to benefit by ¼ per cent. in the dividend. He did not think that this was borne in mind by the public. He also drew attention to the large item of £3114 for law, and asked if part of it was due to the late action of the other Company.

The Chairman, in reply, said he was much obliged to Mr. Coppin for drawing attention to the item of law charges. Happily this had not been in any way connected with The Gaslight and Coke Company; that was all cleared off last time. That Company had had their "pound of flesh;" and he hoped they enjoyed it. The law expenses had been due to their having incurred very heavy charges in the matter of the rating. These had all been paid, and the Company had reduced their general rates, by the expense thus incurred, by about £4000 or £5000 a year. He supposed that out of the total law charges of £3000, £2500 was attributable to the expenses they had incurred in getting their rates reduced. With reference to the London County Council, he desired to guard himself against saying anything detrimental to that body; because no one could have met them more fairly than did the Chairman and Deputy-Chairman and the Chairman of the Sanitary Purposes Committee. What he had stated about the tester to whom he had referred was that, after he had learnt his business—after some few months, during which he was gaining his experience, and the Company had to spend 2d. per 1000 cubic feet in enriching the gas and making it over 18 candles at the testing place—he became efficient; and the Company then went back to the old state of things, or very nearly so. What they complained of was that the London County Council appointed inexperienced men, and that they had to be taught at the Company's expense. With reference to the dividend, he was glad that Mr. Coppin had referred to their having given up a portion of the dividend to which they had been entitled. He thought that this ought to be remembered; but the proceeding served them well now. They had been entitled to a dividend of 13¾ per cent. They were paying 13¼ per cent. before the strike, and they reduced it to 12 per cent. for two half years, in order to pay for part of the cost of the strike. The shareholders gave up £30,000 for this purpose, and, as far as he could see, they had never regretted doing so; on the contrary, they seemed to have been proud of having had their share in that work. They afterwards went up to 13 per cent. They were now entitled, and they had been entitled for the last five half years, to 13¾ per cent., but they had only paid 13 per cent. Now, however, that they were raising the price of their gas by 3d. per 1000 feet, they would still be entitled to pay 13 per cent.; and this was the dividend they intended to pay next half year.

The Deputy-Chairman (Mr. John Mews) then proposed the following resolution: "That a dividend at the rate of 13 per cent. per annum be now declared, and that such dividend, with the exception of the sum of £500, be apportioned amongst the three classes of stock as prescribed by the Scheme of Amalgamation, 1880, and that the warrants be transmitted to the registered addresses of the proprietors by post."

Mr. Simpson Rostron, in seconding the motion, observed that the Chairman had just taken the words out of his mouth which he had intended to address to them, so as to remove the possibility of any doubt that, by raising the price of their gas, as they now proposed to do, they would have to reduce their dividend. In consequence of not having "divided up to the hilt," they were now enabled to raise the price of their gas without having to lower the dividend.

The resolution was carried unanimously.

The Chairman then proposed a resolution increasing the Secretary's salary by £200 per annum from the 1st of January last. Mr. Bush, he reminded them, was appointed nine years ago, and he had served them faithfully, earnestly, and thoroughly, during that period; and they were perfectly satisfied with the way in which he discharged his duties.

The Deputy-Chairman seconded the motion, which was carried unanimously.

Mr. Franklin then proposed, and Mr. W. Perrin seconded, a vote of thanks to the Chairman and Directors. The latter gentleman referred to his having attended a "garden party" given last Saturday by the Directors to the employees; and he testified, from what he saw on that occasion, and from conversations which he had held with some of the men, to the cordial relations now subsisting between the Directors and the workmen, and to the high esteem in which Mr. Livesey—or, as one of the old hands called him, "young George"—was held.

The resolution was carried unanimously.

The Chairman, in reply, stated that the gathering referred to by Mr. Perrin arose from the men having invited the Directors last year to meet them in the cricket ground, to express their satisfaction with the manner in which they had been treated. The Board were so pleased with their reception last year by the men that they thought they would invite the men and their wives this year, and give them a tea. He had not been aware that Mr. Perrin was present on the occasion; but he was very glad to hear that he had been among them, and that he had ascertained for himself the cordiality of the relations which now so happily subsisted between them and the men. His colleagues and himself thoroughly appreciated the confidence and goodwill manifested towards them by the shareholders. Continuing, the Chairman proposed a vote of thanks to the Engineer, his Assistants at the various works, and to the Secretary and staff. He wished the shareholders to feel that they had a thoroughly devoted and loyal band of officers, all of whom did their utmost to promote the welfare of the Company. With reference to the workmen, they were a thoroughly good class, and were doing their best to serve the Company.

Mr. Morton, as an old officer of a Gas Company for a good many years, desired to second the resolution, which was carried.

The Chief Engineer (Mr. Frank Livesey), in acknowledging the vote, stated with regard to the men, that the work had never been done better than it was at the present time. The men and the officers were interested in the profit-sharing scheme, and the workpeople had found out already the benefit of this principle. They could not control the price of coal; but they would all do their utmost to get the price of gas down to its former figure.

The Secretary also acknowledged the vote; and the proceedings then terminated.

LIVERPOOL UNITED GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held last Tuesday—Mr. E. Lawrence in the chair.

The Directors' report stated that the revenue during the past year amounted to £542,797, and the expenditure to £452,700; leaving a surplus of £90,096. After deducting the amount taken for the payment of the interim dividend, and the interest on the bond and debenture debt, there remained a balance of £43,725. The Directors recommended that a dividend for the half year ending June 30 last be declared of 5 per cent. on the ordinary consolidated stock, and 3½ per cent. on the 7 per cent. stock. To provide the amount required for these payments, it would be necessary to have recourse to the reserve fund to the extent of £3574. The accounts showed that, while the revenue of the Company during the past year exceeded that of the preceding twelve months by £19,516, the expenditure has been increased by £39,618, owing to the largely enhanced cost of producing gas of the quality prescribed by the Company's Acts of Parliament; and as the cost of production would be still greater during the current year, the Directors had been obliged to announce a corresponding increase in the price of gas (4d. per 1000 cubic feet).

The Chairman, in moving the adoption of the report, first called attention to the variation of £20,843 in the amount of capital which had been raised. During the year, they had received debenture money amounting to £76,118, and had paid off bonds representing £55,275—making an addition to the capital of £120,842. Then on the other side they had had an expenditure of £48,517. This was a larger amount than they had expended in late years; but it was rendered necessary owing to the extension of their works. With regard to the revenue account, the outlay incurred in the manufacture was practically the same as last year; being £173,062, or an increase of only £350. Coal had cost them during the past year 17s. 2·18d. per ton, against 15s. 3·36d. the year before; or in round figures 2s. a ton more. This entailed an additional expenditure—connected also with the fact that there was an increase of 3 per cent. in the consumption—of £38,751. On the other side they would find the revenue increased by the sum of £12,000 on the sale of gas, which gave an increase of 3 per cent. for the year. The profits on coke showed an increase of £6836; on tar, of £2821; while on ammoniacal liquor there was a diminution of £1578, which arose from the fact that the price of sulphate of ammonia had declined considerably during the year. Their working expenses were practically the same as before; and the total result

was that at the close of the year, they found themselves with a balance on revenue account of £90,097. They needed £94,600 for dividends, and £9156 for mortgage and debenture stock interest; making a total of £103,756, and showing a deficiency for the year on those figures of £13,659. This did not quite represent the loss on the making of gas during the past year; for the reason that they had credited to the revenue account two items amounting in the aggregate to £5090. These items arose from the following facts: That in their last year's accounts, they had charged to revenue for various small matters a sum of £3710. Exception was taken to this expenditure as revenue by the Public Accountant; and though all the items so charged to revenue were open to argument as reasonable charges, yet under the circumstances, as he recommended that they should be treated as a capital charge, the Company had transferred them back to the capital account. Having mentioned other items in the accounts, the Chairman said the exact deficiency during the year was £18,749. Against that, however, they had a balance brought forward from the previous year of £10,084; but as the accounts only showed £1375, it left a final deficiency of £564 to be dealt with. Having alluded to some of the correspondence which had appeared in the local papers regarding the increase in the price of gas, he admitted that people had a right to complain of it. The public naturally complained when they were asked to pay more money; and therefore he wished to give them every explanation that it was in his power to afford. It had been said that the increase had been put on unexpectedly. He did not see how this could be, considering that eighteen months ago, he told the public very candidly that he expected shortly to have to announce a rise in the price of gas; and the only reason it did not take place last year was that the Company had an unexpired contract with the Wigan Coal Company before the rise of 7s. a ton in the price of coal took place. Therefore he thought the public ought to see that last year they were protected by the action of the Company from the price of gas being unduly raised by them as it had been by many other companies. From the remarks made outside, one would suppose that the Liverpool Gas Company was the only company that had increased the price of gas. The following out of many others had raised their price: Bath, with 16-candle power gas, by 3d.; Bolton, with 18-candle power gas, by 2d.; Leeds Corporation, with 19¼-candle power gas, by 4d.; Dublin, with 17-candle power gas, by 3d.; Aberdeen, with 25-candle power gas, by 2d.; Oldham Corporation, with 20-candle power gas, by 2d.; Nottingham, with 18-candle power gas, by 2d.; Bury, with 18-candle power gas, by 3d.; The Gaslight and Coke Company, with 16-candle power gas, by 3d., and on the cannel gas by 4d.; Leamington, with 18-candle power gas, by 3d.; Edinburgh, with 25-candle power gas, by 9d. The South Metropolitan Company were also about to raise their price by 3d. So that the Liverpool Company (supplying gas of nearly 22-candle power) had been compelled to do what other companies had already done. He wished now to show the reason they had for making the change in the price. He had shown that the deficiency during the past year was £18,749. They knew now that the coal for the coming year would cost them 2s. a ton more than last year—that was to say, an additional expenditure of £30,000—these two items making £48,000, and representing 4d. per 1000 cubic feet. It was said that coal had decreased in price; and it was asked why should the price of gas be raised. They had advertised and received a large number of tenders so far back as March last; and they found the price of ordinary coal was practically the same as it was in previous years, but that the price of cannel had risen from 17s. or 18s. per ton to 24s. 6d. They had to deal with the facts; and they made the best contracts they could. It might be astonishing to see the increase; but the cause of it was that the Wigan cannel fields were becoming exhausted, and Scotch cannel was very expensive, because it was sought for in every direction. Australian shale, too, had risen in price; but it was no more expensive than Wigan cannel. The Company were doing the best they possibly could. Comparing their expenses with those incurred by other companies, they were not the extravagant body that some people would try to make them out to be. There had been from time to time some talk about the Liverpool Corporation purchasing the undertaking, as it was supposed they would save £50,000 to £60,000 a year for the ratepayers. There was always a disposition on the part of the Directors of the Company to sell upon fair and reasonable terms. If they so desired it, at any time they wished, the Corporation would find the Company ready to treat with them. A proposal was made fourteen or fifteen years ago, and negotiations were entered into; but the electric light burst in upon them at the moment, and the Corporation were frightened, and had no more to say to the Company. He had examined statistics on the subject; and he found that out of 914 companies in England, there was not one producing gas of as good a quality as the Liverpool Company, and there were only 120 companies supplying gas cheaper, always remembering that the quality was inferior to Liverpool. Of the bulk of the remainder, the price was much higher, and the quality of the article was much lower. These statistics forced upon him the conclusion that, if the whole of England was content with a lower quality of gas than they were using in Liverpool, why should the Liverpool Company maintain their high standard? What was good enough for the overwhelming majority of the people of England ought to be good enough for the people of Liverpool; and if the people of Liverpool through the Corporation would support the Gas Company in an application to Parliament to remove from the Company the restrictions they were under as to the quality of the gas they supplied, they (the Company) would be happy to go to Parliament for the purpose. It would then be in their power to supply the people of Liverpool with gas as cheap as was to be had in other places in England. He would be glad if the Corporation would take up his suggestion, because it would enable the Company to do justice to the interests of the shareholders as well as to those of the ratepayers of Liverpool. He hoped the time would soon come when they would again be able to announce a reduction in the price of gas, and that it would be as cheap as it was for a number of years past.

Mr. W. B. GILMOUR seconded the motion, which was carried.

Resolutions were then passed declaring the dividends recommended, and re-electing the retiring Directors and Auditor.

A vote of thanks to the Chairman terminated the proceedings.

BRISTOL GAS COMPANY.

Half-Yearly Report and Accounts.

The Directors of the above Company, in the report which accompanies the statement of accounts for the six months ended June 30 last, and which will be submitted to the shareholders next Friday, say that, notwithstanding the continued high prices of coals and other materials, and the very heavy outlay on renewals and repairs of plant, there will be a balance of £6968 to be carried to the credit of the current half-year's account, after providing for the maximum dividend of 10 per cent. There has been an increase in the consumption of gas of rather more than 9 per cent. during the six months as compared with the corresponding half of last year. In order to provide for the continually increasing demand for the supply of gas, the Directors find it necessary to at once commence making considerable extensions; and as the balance of capital raised is now very small, they propose to ask the proprietors to authorize a further issue of ordinary and debenture stock. The Directors report that the Bill promoted in Parliament during the last session, received the Royal Assent on July 21 last. Turning to the accounts, it is seen that the amount of capital expended in the half year (after crediting the account with £348 for depreciation of stoves) was £11,501; making the total capital expenditure to June 30, £782,142, and leaving a balance of only £3536. The income of the Company for the half year was £128,837, as against £104,656 in the corresponding half of 1890. The former sum was made up as follows: By the sale of gas, £100,249; rental of meters and stoves and profit on the sale of stoves, &c., £1877; residual products, £26,483; rents, £209; and transfer fees, £18. The expenditure totalled to £104,089, as compared with £78,568. In the manufacture of gas £86,281 was spent (coal costing £49,448); in the distribution, £5296; in lighting and public lamps, £2329; in rents, rates, and taxes, £3516; in management, £5044; and the balance of the £104,089 was made up of minor items. The amount carried to the profit and loss account is £24,747, as against £26,088; the balance now available for dividend being £29,181. The quantity of common coal carbonized during the six months was 67,387 tons, and of cannel 18,464 tons. The amount of gas made was, 781,374,000 cubic feet, of which 703,231,974 feet were accounted for, and 78,142,026 unaccounted for.

CROYDON COMMERCIAL GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Wednesday, at the Offices, Katherine Street, Croydon—Mr. C. NEWTON in the chair.

The SECRETARY (Mr. W. J. Russell) read the notice convening the meeting; and the Directors' report and the statement of accounts for the past six months, some particulars from which were given in the JOURNAL last week, were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said the first paragraph of the former showed that they had had a most successful half-year's working. The shareholders would have noticed in the daily papers that, in consequence of the high price of coal, gas companies had not been in a very flourishing condition during the past six months. He was glad to say that this was not shared in by their own Company; inasmuch as they were fortunate in having a satisfactory contract unexpired, and of which they availed themselves. Instead of having to increase the price of gas, they were placed in a position a little nearer a reduction; and, considering that they had earned sufficient to pay the dividend, this was very gratifying. The increase in the quantity of gas sold during the half year had amounted to a little more than 20 million cubic feet; besides which a higher price had been obtained for the coke and tar. These increases were rather abnormal; and were no doubt due, in a great measure, to the severity of the early part of the winter, which was most unusual, and probably caused a greater use of gas and coke than would otherwise have taken place. Reverting to the subject of the increased cost of coals, he stated that the Directors had been fortunate in obtaining a contract for the coals required during the next three years at a figure which they considered very satisfactory. With regard to the alterations and additions to the plant at the works which were referred to in the last report, these had now been commenced. They had fixed two large governors, which they required in consequence of the increased quantity of gas now sent out; and they had sold their old station meter, and purchased one nearly double the size. They were also adding a third lift to one of the gasholders; and, although this was to some extent expensive, it was a much more judicious plan of obtaining additional storeage accommodation than putting up a new holder. This was suggested to the Directors by their Engineer (Mr. J. W. Helps); and he (the Chairman) was sure it would meet with the approval of the shareholders when they learnt that it would only cost a few thousand pounds, instead of, in the case of an entirely new holder, perhaps £25,000, the greater portion of which would be lying idle for some years, as they had no requirement at present for another large holder. The report also referred to the small amount of working capital left. The Directors had never had a very large balance of capital to work with, as they had kept it as close as possible to enable them to carry on the concern as prosperously as they could. The balance had now dwindled down, principally through the increased quantity of stoves and meters the Directors had had to purchase, and the large number of mains they had to keep in a thorough state of repair. They renewed all their service-pipes without charging capital anything for them, because after a time they became useless, and they then substituted new ones, which was better than writing off for depreciation. The balance on the capital account being only £21 14s. 7d., the Directors had resolved to issue, by tender, 500 ordinary £10 shares; and they hoped this would provide them with capital sufficient to last for some time to come. This opinion he based upon what he recollected with regard to the previous issue of capital. In 1884 they raised a small additional sum; and since then they had not raised anything, except about £100. Nearly the whole of that money had been expended in the purchase of distribution plant, which had been of very valuable use to the Company. During the past eight years, there

had not been any extension of the manufacturing plant; but just before then, they had four new purifiers put down. When he informed the shareholders that they were at that time sending out 340 million cubic feet of gas annually, and 408 millions at the present time (being an increase of 68 millions, or 20 per cent.), he thought they would agree that the application for additional capital was not an unreasonable one. Proceeding, the Chairman mentioned that they had had a large increase in the sales and hire of gas-stoves; the number which they had out on hire alone being now 1595. As he had before remarked, the result of the half-year's working had been very satisfactory. They had sufficient profit to enable them to pay the usual dividends, and to meet the other liabilities—such as debenture interest and so on—and to add to the unappropriated balance the sum of £230. Turning to the accounts, the Chairman pointed out the increases which they had had in the various items of revenue in comparison with the corresponding period of last year—amounting altogether to £4587. In this connection, he referred to the plan which they had adopted of furnishing the tenants of small houses with fittings on hire, and supplying them with gas on the prepayment system. They charged a nominal rent of 2d. per week for the fittings; and during the past half year there was an increase in this rental of £9. This, it was true, was only a small amount: but the plan was developing very rapidly. In dealing with the various increases on the expenditure side of the account, he spoke of the liberal way in which the Directors treated their workmen, and of the provisions which they had made for their comfort and recreation—all of which would have a beneficial effect upon the men, and would indirectly be of advantage to the Company. The total additional expenditure was £4486, as against an increased income of £4587. The unappropriated balance amounted to £19,620; and after paying the dividends, they would have remaining £8445, which was about two-thirds of what they would require for the current half-year's dividends.

Mr. W. HYSLOP seconded the motion, which was at once unanimously carried.

On the motion of the CHAIRMAN, seconded by Mr. BARRATT, dividends were declared at the rate of 14 per cent. per annum on the capital of £51,600, and at the rate of 11 per cent. on the capital of £137,500 less income-tax.

A vote of thanks was passed to the officials and staff for the assiduous attention which they had given to the affairs of the Company during the past six months, and also to the Directors for their careful management of the concern.

The meeting then terminated.

GREENOCK CORPORATION GAS SUPPLY.

The Annual Statement of Accounts—The Price of Gas.

The Police Commissioners of Greenock, who also constitute the Gas Trust of the burgh, have lately completed their statement of accounts for the year ending June 30 last; and more recently they have fixed the price of gas for the current year. The following are the principal items of revenue: Consumers by meter, £25,914, as compared with £24,891 in 1890; do. by contract, £2336, against £2302; residual products, £6382, against £5787; rental of gas-stoves, £66, against £49—other items bringing up the total revenue to £39,069, as compared with £37,620. The expenditure for coals in the past year was £12,896, as compared with £11,188 in the twelve months ending June, 1890; wages and salaries came to £6450, against £5745; interest and sinking fund charges were £8149, against £8242; and the total ordinary expenditure was £36,849, as compared with £33,845. An item of £179 of extraordinary expenditure for gas-meters brought up the total to £37,028, against £34,164; making the profit £2041 last year as compared with £3456 in 1889-90. The capital account showed on the debtor side a total of £154,301, brought up to £156,342 by the addition of the £2041 of profits. On the other side, the property account stood for £139,300, the stock account for £5724, the outstanding debts for gas for £390, the outstanding sales for £799, and the miscellaneous amounts for £10,127.

At the meeting of the Police Board at which the accounts were submitted, it was reported that the Town Clerk had given his opinion regarding the appropriation of the surplus of £2041, which was that according to the 87th section of the Gas Act of 1871, it was provided that the Board "shall carry any balance thereof to the credit of the Board, for their general purposes." Bailie Erskine, the Convener of the Gas Committee, stated at considerable length what had transpired in Committee regarding the accounts, the allocation of the year's profits, and the mode of providing for the payment for the new gasholder that had been contracted for. He then moved the adoption of the minutes of the Committee, and the motion was seconded by Mr. Bell. Bailie Anderson thought the Committee and Bailie Erskine deserved to be congratulated on the successful result of the operations during the past year. Mr. Nicholson asked if the gas profits could be used for such a purpose as paying for the cost of the new gasholder, as, if so, he maintained that it was very unfair to hand over the profits to the Police Board, and at the same time, by contracting for a new gasholder, add to the already large accumulated debt. If the profits were handed over, and if more debt was contracted, the result was that consumers paid not only their full share of rates, but were actually, through the handing over of the profits, helping to pay the rates of parties who did not consume gas; and non-consumers of gas, instead of being on the decrease, were rather on the increase. He therefore thought that the recommendation of the Committee should not be adopted if the profits could be legitimately applied to defray such expenses as the cost of the new gasholder. The Town Clerk was appealed to; and he replied, with reference to the expenditure for the new gasholder, that it was stated in the Act that it was to be treated as a capital charge. It was so dealt with by the Committee who had charge of the original undertaking; for they deferred the erection of the gasholder at the time for a period of seven years, for the purpose of saving the interest on the cost. They did not require to erect the holder at the end of that period; but it was plainly and surely a portion of capital, and the money required for the purpose must be dealt with as a capital charge. He further stated that his opinion, from the reading of the Act, was that the profits could not be applied in payment for the holder. The discussion was continued for some time; but, in view of the opinion given by the Town Clerk on the subject at issue, no opposition motion was submitted, and the minutes were passed without a division.

At a meeting of the Gas Trust held a few days ago, the question of the price of gas for the current year came up for consideration. In the minutes of the Gas Committee, there was submitted the estimate of the probable revenue, expenditure, and profits for the year ending June 30, 1892. The following were the totals: Revenue, £39,715; ordinary expenditure, £30,325; extraordinary expenditure (new gas-meters, mains, and service-pipes), £300—total, £30,625. The estimates of sinking fund, interest, and net profits were £3000, £5250, and £840—together, £9090; making up the above-mentioned amount of £39,715. This estimate was signed by Mr. S. Stewart, the Manager, and Mr. J. Chalmers, Collector. The minutes stated that a motion was made to approve of the estimate; and this was seconded. An amendment was proposed to the effect that it be not approved of until the sinking fund was separated from the working charges. As the amendment was not seconded, it fell to the ground. Then a motion was made by the Convener to the effect that, in view of the estimate submitted, the price of gas for the current year remain at 3s. 4d. per 1000 cubic feet. An amendment was moved and seconded that the price be reduced to 3s. 2½d. There were six votes each for the motion and the amendment; and the Convener gave his casting vote in favour of the motion, which was declared carried. When the minutes were submitted by the Convener at the meeting of the Gas Trust, he enlarged on them at considerable length. He referred to other towns in Scotland where the price of gas had been fixed for the year—such as Paisley, Glasgow, Dundee, Aberdeen, Edinburgh and Leith, and Perth—in some of which the price remained unchanged, while in the others it had been advanced; and he thought that they might have been warranted in increasing the price in Greenock. If they made such a reduction as had been suggested, he calculated that they would be behind at the end of the year to the extent of £1700, or twice the estimated profits of the current year. Mr. Mitchell, in a long speech bristling with figures and really sound arguments, moved that the price of gas be reduced 2½d. per 1000 cubic feet; the reduction to take place from November, and continue during the last six months of the year. Bailie Borland seconded the amendment. Another amendment was submitted—that the price be reduced from 3s. 4d. to 3s. 3d. per 1000 cubic feet. Eventually, on a division, this and the original motion each received 11 votes. The Provost gave his casting vote in favour of the motion. In the first division, 12 votes were recorded for the motion and 10 for Mr. Mitchell's amendment. The price of gas will therefore be continued for the year at 3s. 4d. per 1000 cubic feet, against 2s. 10d. in Paisley and 2s. 6d. in Glasgow—the two nearest large towns to Greenock.

THE LONDON COUNTY COUNCIL AND THE TESTING OF GAS

The following is the text of the letter addressed by Mr. G. Livesey to the Clerk of the London County Council (Mr. H. De la Hooke), in April last, on the subject of the testing of gas in the Metropolis, and referred to in the course of his remarks at the meeting of the South Metropolitan Gas Company on Wednesday, as reported in another part of the JOURNAL:—

H. De la Hooke, Esq., *April* 24, 1891.

Sir,—The present relations between the Council and the Gas Companies, carried on through the medium of the Police Courts, are not satisfactory, neither are they, as will be proved, to the advantage of the public. The Board of this Company, therefore, on whose behalf I write, consider it their duty to communicate directly with the Council on the supply and testing of gas.

An impression exists that the Gas Companies, unless very strictly watched, would not act up to their parliamentary obligations, but would deal unjustly to the consumers; ignoring the fact that the strong competition of oil and electricity is alone sufficient to impel the Companies to do everything in their power to meet the requirements of the public. There is also the sliding scale, which makes the interests of the Companies identical with those of the consumers. The saving of 1d. only per 1000 feet on the cost of gas in the case of this Company secures £26,000 a year to the consumers, while it entitles the shareholders to ¼ per cent. additional dividend, or only £5000; and, on the other hand, 1d. permanently added to the cost of gas would take £26,000 a year from the consumers, and nothing from the shareholders, because at present the dividend is ¾ per cent. below that which might be paid at the price of 2s. 3d. per 1000 cubic feet now charged.

Unfortunately, in consequence of the great rise in coal and labour during the last two years, it is not now a question of reducing, but of preventing an increase in the price of gas. The low price of 2s. 3d. has only been maintained by reducing the dividend by £30,000, to pay part of the cost of the strike, and by using about £140,000 from the reserve fund, exclusive of the strike expenses. The absorption of this large sum—above half of the amount accumulated at compound interest during 30 years—is proof of an earnest desire on the part of the Board to keep down the price under very adverse circumstances. The dividend, no doubt is considered high; but it must not be forgotten that since 1876, at the initiative of your Vice-Chairman (Sir Thomas Farrer), all new capital has been sold by auction—thus providing money for extensions of business at nominally 12 or 13 per cent., but at an actual charge of 5 or 5¼ per cent. only. Moreover, in the last eight years, the Company have raised three-quarters of a million of capital for extensions of works by debenture stock, sold by auction at a charge of only 3¾ per cent.; therefore, considering the necessity of providing good gas at the lowest possible price, for the multifarious purposes of heating, cooking, trade, and manufacture, as well as for lighting, the Board feel it is reasonable to expect the assistance of the public authorities in attaining so desirable an object.

It is a common impression that the higher the illuminating power the Gas Companies can be induced or forced to give, the better it will be for the consumers. There would be something in it, but not much, if the increased quality could be obtained at the same, or nearly the

same, proportionate cost; but the cost being six or eight times greater, the supposed advantage is converted into a downright loss to the consumers.

As the result of this mistaken view, the photometer, the candles, and the system of testing have been so altered that the same quality of gas, which was of full 16-candle power when this Company, by their Act of 1876, voluntarily met the public requirements for an increase in the standard from 14 to 16 candles, has now an apparent value of only 15 candles. It is therefore necessary, in place of 16½ candles, to make the gas equal to 17½ candles at the works; and even this is not sufficient to protect the Companies from prosecution in the Police Courts. The tests from day to day are so uncertain (for while one tester constantly reports about 16 candles, another, on taking his place for a few days, as regularly returns 17, which goes back to the old figure when the permanent tester resumes his duty), that the officers of the Company never know, until they see the reports in the morning, whether the Company will be subject to prosecution or not. In fact, I am in a position to say that the uncertainty of the tests is a great source of anxiety, and frequently occupies time and thought that could be much better devoted in other ways to the public interest.

I now proceed to demonstrate that this increase in illuminating power, which is being forced upon the Companies by altering the measure on which the bargain was made when the Acts were passed, and by the view which appears to be growing in favour that the lower the reports of the testers the better for the consumers, is not only not to their advantage, but most distinctly to their disadvantage and loss.

The illuminating power and the price of gas in any given district are dependent upon the available supply of coal. In the case of London, Durham is the only coal-field whence the enormous demand—about 3,000,000 tons a year—can be met; and as Durham coal will not yield more than 16-candle gas, that is the practical and economical limit for London. The gas can, of course, be enriched by expensive cannel, rapidly becoming scarcer and dearer, or rather less expensively by gasoline; but the use of either must be at an excessive cost to the consumers.

The average cost of Durham coal, less residuals, is below 4½d. for 1000 cubic feet of good 16-candle gas, or 16½ candles at the works, according to the tests of 1876. To increase it to 17 candles or 17½ candles at the works (the lowest quality that the present system of testing, if persisted in, permits), 6 per cent. of cannel must be used, which brings up the average of cost of coal and cannel, exclusive of all other charges, to 7d. per 1000 feet of 17-candle gas, against only 4½d. for 16-candle, or 2½d. for the extra candle. But taking it at 2d., it is not worth what it will cost to the consumers who must pay for it; consequently, it is clearly to their interest that the quality which can be obtained from ordinary coal without cannel or gasoline should be supplied.

If the higher quality is insisted upon, the consumers must pay 2d. per 1000 feet more for their gas, which, for this Company alone, amounts to £52,000 a year, and for the three London Companies to £225,000 a year, for an inappreciable advantage even for lighting, while the higher quality is no advantage whatever for heating, cooking, and manufacturing. Consumers can obtain several candles' additional light out of 16-candle gas by the adoption of the new methods of burning, and the improved burners now in the market. The "Standard" burner was the best when the present system of testing was inaugurated; giving, with 16-candle gas, 3·2 candles per foot. But now, from 6 to 10 candles per foot can be obtained from the regenerative burners; whereas very few of the ordinary burners in use yield 3, or even 2½, candles per foot. In fact, a very large proportion of the consumers can easily obtain from 20 to 40 per cent. more light by the use of better burners, or by discarding coloured globes or globes with small openings. Moreover, the richer the gas, the greater the tendency to smoke; causing annoyance and loss to the consumers and complaints to the Companies of "dirty"—that is, smoky or rich—gas.

I make no charge against any of the testers appointed by the Council; but I must say that confidence in the judgment of some of them in the use of the present unreliable standard—the candle—is shaken, which may result in compelling the Company to choose between being constantly summoned for reported defective power, or an increase of 2d. per 1000 cubic feet in the price. The Board feel very strongly that the system of testing, coupled with the alteration in the photometer, and the candles (which is, in effect, an enlargement of the measure on which the contract was based), is unjust to the Companies and disadvantageous to the public. The individual tester, in the use of the candles, may make good gas appear inferior, or *vice versâ*. Moreover, as he has authority to make the tests at any time in the 24 hours, it often happens that the gas is taken at a disadvantage, by making them in the early part of the day, when there is little or no consumption, when, instead of obtaining the fair average quality over the 24 hours, which is specifically set forth as the object, the test shows the quality only of the small sample of gas that is lying dead in the mains. The Council could obviate this injustice by ordering that two out of the three daily tests should be taken in the evening, during the hours of greatest consumption. In this connection, it may be stated that the higher quality, even if a benefit at night, is of not the slightest advantage in the daytime, or for cooking or heating and many other purposes.

As any increase in the quality of the gas must be paid for by the consumers in the shape of a higher price, without reduction of the present dividend, the question naturally arises: Why does not the Company at once meet the requirements of the system of testing, increase the quality, and put up the price? The answer is that the Board are convinced (and their action in the last two years gives abundant proof of the sincerity of their conviction) that, in the interest of the Company and of their partners, the consumers, gas at the lowest possible price is essential; that as quality and price cannot be separated, but must be considered together, the quality—viz., a fair 16-candle gas, obtainable from Durham coal alone without cannel—is most to the advantage of the consumers, and would give promise of further reductions; and that to increase the price would convey the impression that the lowest point had been reached, and thus check the further development in the use of gas for its multifarious purposes, particularly for heating, on which, encouraged by the low price, additional business and still lower prices mainly depend, and which is the most hopeful means of reducing the smoke of London.

Under these circumstances, the Board think they may expect the friendly co-operation of the London County Council; and I am requested to say that they will be glad to send a deputation to discuss the question, and to give any explanation or information the Council may desire—hoping thus to put the relations of the Council and the Company on a satisfactory footing.

THE MATLOCK AND DISTRICT GAS COMPANY'S NEW WORKS.

A new era in the history of the Matlock and District Gas Company was commenced auspiciously last Wednesday week, when the additional works which have been recently erected were opened. The past five years of the existence of the Company have been full of interest from a shareholder's point of view; and the increase in the value of the property in that time has been very considerable. Shortly after the formation of the Company, it was found imperatively necessary to extend the productive capacity; and as time rolled on, there has been an ever-recurring indication that other additions would have to be made to cope with the consumption of gas in the rapidly growing district of Matlock. The figures of the Company show that since it was formed the consumption of gas has more than doubled; and with the old plant, it was simply impossible to deal with the demand. Accordingly, about five years ago they built a new gasholder, thinking that this would be sufficient for some time; but even this has been found to be totally inadequate. They therefore resolved to erect new works; and these have now been completed. The main feature is a new retort-house. The building is very commodious; and at present contains six beds, comprising seven retorts each. These are on the generator principle; and the capacity of production represents 6000 cubic feet of gas each per diem. This gives the total production per day at 258,000 cubic feet, and shows an interesting comparison with the old system, which has now been superseded. The old retorts numbered 33 in all, and were only capable of producing 4000 feet each per day. This gives an aggregate of only 136,000 feet; thus leaving 122,000 feet which has been added to the producing powers of the Company, or very nearly double what they were able to supply until the new works were started. Besides this there is provision made for fourteen more retorts, which would mean another 84,000 feet of gas per day; so that they are well provided for all possible contingencies. Other structural alterations include the removal of part of the old block of buildings to make room for a new engine-house of very large capacity. This building has been covered by a capacious tank for the purpose of increasing the storeage for tar, ammoniacal liquor, and water. A new exhauster has been supplied by Messrs. Bryan Donkin and Co., of London; and it will pass 15,000 cubic feet of gas per hour. The whole of the buildings are composed of substantial gritstone walls; and the works have now a very imposing appearance. In the old block of buildings a new boiler has been fixed, measuring 14 feet in length and 5 feet in diameter. This has been supplied by Messrs. Clayton, Son, and Co., of Leeds; and its position is in a direct line with the engine-house. The additions also include a new governor-house, which has accommodation for the Manager's offices, &c. Here a new 8-inch governor has been placed, and the whole of the Company's district is now served by governors—the Rowsley and Darley Dale sections having been without them until now. The old retort-house is to be cleared out, and the space utilized for coal-stores, which are much needed. There has also been an increase in the storeage capacity, and one of the old gasholders has been telescoped. This work has been carried out by Messrs. Clayton, Son, and Co., of Leeds, on Messrs. Gadd and Mason's system of guiding. The second holder will accommodate 60,000 cubic feet; and there is a third at the works, which will take a further 18,000 feet. Adjoining the engine-house, there has been placed two new steam-pumps, Evans's "Reliables," one of which will be used for pumping tar and liquor from the underground tank into the overhead tank, and also for pumping ammoniacal liquor through the scrubber. The other pump is intended for clean water, which is drawn from a well sunk on the premises. The management have also caused a thorough examination to be made of the mains in the district, and where necessary they have been replaced. The districts served by the Company include Matlock, Matlock Bath (partly), Darley Dale, Rowsley, and Riber. The new works have been carried out to the plans and under the direction of Mr. T. Newbigging, C.E., of Manchester. The masonry has been executed by Messrs. J. Walker and Sons, of Matlock; the ironwork, by Messrs. Clapham Bros., of Keighley; the retort-benches, by Mr. C. Dennis, of Bury; while Messrs. Newton, Chambers, and Co., of Thorncliffe, near Sheffield, supplied the cast-iron tank. The opening ceremony was performed during the afternoon of last Wednesday week, by Dr. Harrison, J.P., the Chairman of the Company. He was accompanied by the Directors, Mr. Robert Hall, the General Manager and Secretary, Mr. T. Brown, the Works Manager, and a number of friends. Punctually at the time arranged for the ceremony, Dr. Harrison threw the first supply of coal into the retort, and afterwards they were all charged. Everything worked satisfactorily and without a hitch, which reflected the greatest possible credit on the efficiency of the plant now provided.

Proposed Lighting of Helston by Oil-Lamps.—The Town Council of Helston yesterday week appointed a Committee to "take all necessary steps forthwith to invite tenders for the lighting of the town with oil-lamps in an efficient manner, and, if necessary, on account of urgency, to enter into necessary contracts for carrying out the lighting, avoiding, if possible (in view of electricity in future), the purchase of any oil-lamps." The Committee were also allowed £10 for the purpose of consulting an electrical engineer as to the probable cost of lighting the streets by electricity.

PROVINCIAL GAS AND WATER COMPANIES.

The following paragraphs contain some particulars as to the working of various Provincial Gas and Water Companies during the periods mentioned.

Gas Companies.

The half-yearly general meeting of the Aldershot Gas and Water Company was held on the 5th inst., under the presidency of Mr. A. F. Wilson, Assoc. M. Inst. C. E. The report of the Directors stated that the sale of gas in the past half year had increased 10 per cent. as compared with the six months ending June 30, 1890; while the sale of water to both the town and the Government was very much greater than in that period. One of the gasholders is being telescoped; and alterations in the water plant are in progress. In order to meet these charges and the cost of sundry extensions of mains, the Directors propose to issue some 6 per cent. preference shares. The Chairman, in moving the adoption of the report and the declaration of dividends at the rates of 10 and 7 per cent. per annum, said the shareholders had reason to congratulate themselves on the satisfactory financial position of the Company, notwithstanding the very large increase which had taken place in expenditure, in consequence of the advanced price of coal. This was at the rate of 3s. 3½d. per ton over the corresponding period of last year, and amounted for the past six months to £578. The total additional outlay was £681, or, less that caused by the higher price of coal alone, £103. Against this there had been more revenue by £579, which fully balanced the extra cost of coal, and left only £102 less than last year. They had used 124 tons of coal more than in the corresponding six months of 1890, with an augmented sale of gas amounting to 1,607,000 cubic feet; and the leakage was only 3·55 per cent. The water supply for the six months was 84,477,000 gallons, against 58,082,000 gallons in the corresponding period of last year—being an increase of fully 45 per cent. It was very satisfactory to know that this large quantity of water had been delivered without a hitch, either as regarded the Government or the private consumers; and he was happy to say that there had been no scarcity of water. Mr. Brown seconded the motion, and it was carried unanimously. A vote of thanks having been accorded to the Chairman and Directors, the former, in acknowledging the compliment, paid a tribute to the Honorary Secretary (Mr. J. Lightfoot), to whose untiring energy, he said, the shareholders were indebted to a great extent for the present satisfactory state of the Company's affairs.

In moving the adoption of the report and accounts at the recent half-yearly meeting of the Ascot District Gas Company, the Chairman (Mr. R. Berridge, Assoc. M. Inst. C.E.) stated that they showed a profit for the six months of £536, which, added to the balance from the previous account of £676, and after providing for every charge against the half-year's working, left an amount to the credit of the profit and loss account of £1046, out of which the Directors recommended a dividend at the rate of 2 per cent. per annum on the total capital, less income-tax. The report and recommendation as to dividend were adopted.

During the past half year the Bath Gas Company had a most satisfactory increase in the gas-rental from private consumers; but the amount was reduced by a decrease of nearly £600 on the public lamps. The total receipts amounted to £33,821, of which the sale of gas produced £26,202, and residual products £6693. The total expenditure came to £28,004, £23,100 of which was spent under the head of manufacture. The balance of revenue was £5817; and the profit and loss account showed a sum of £10,862 available for distribution. The Directors, in their report, recommend the payment of the maximum dividends.

Reporting upon the progress of the affairs of the Brighton and Hove Gas Company during the six months ending June 30 last, the Directors state that there has been a considerable increase both in the quantity of gas sold and in the value of residual products, as compared with the corresponding half of 1890. The third section of the Company's works, referred to in the previous report, has been commenced; and the new retort-house will be brought into use in the coming winter. The accounts show the gas and meter rental produced £62,249; the residual products, £18,360; and rents, £61—making the total receipts £80,670. The expenditure amounted to £58,116; leaving a balance of £22,554. On the profit and loss account, there is a balance of net profit of £41,478; and out of this the Directors recommend the declaration of the following dividends: Upon the original shares at the rate of 11½ per cent. per annum; on the "A" ordinary shares, at the rate of 8½ per cent.; and on the "B" preference shares, at the rate of 6 per cent.—all less income-tax.

The half-yearly meeting of the Colchester Gas Company was held yesterday week. The revenue account showed a balance of profit amounting to £2003, as against £3859 in the corresponding half of 1890. The gas rental amounted to £9111, being an increase of £813; while coal cost £4772, being an advance of £1209. There was a balance brought forward to the credit of the profit and loss account of £13,085, which, added to the balance of £2003 brought from the trading account, made a total of £15,089, out of which dividends and interest had been paid to the amount of £1944; leaving a balance of £13,144 to be carried forward to the next account. The Chairman (Mr. C. Coleman), in moving the adoption of the report and accounts, stated that the make of gas during the past half year had been much heavier than usual, which the Directors attributed to the unusually prolonged and cold winter. The report was adopted; and dividends of 10 per cent. on the original shares, and 7 per cent. on the new shares, were then declared, free of income-tax.

The ordinary general meeting of the Cork Gas Consumers' Company was held on the 13th inst. The Secretary (Mr. Denny Lane) read the report and statement of accounts, which were noticed in the JOURNAL last week. The Chairman (Mr. T. Mahony), in moving their adoption, referred to the trying period through which gas companies had lately been passing. Fortunately, in their own case, they had contracted for so large a quantity of coal before the advance, that until the present year, they had not been obliged to take any important amount from the invested reserve fund; and what was of more importance to the public, they had not been compelled to raise the price of gas, though still maintaining the usual dividend. The recent rise in the price of coal had been felt most severely, because it had been accompanied by a large increase in the cost of wages. In the uncertainty which prevailed as to the future price of coal, the Directors considered it prudent to husband their resources, and not to exhaust all at once the provision they had made for the future, by requiring immediate delivery of all the coals contracted for; and accordingly they drew some of their supplies from other sources. This had resulted in their still having contracts running for coals at what might be deemed very moderate prices; and lately they had made contracts at a fair price for a quantity sufficient to enable them to look calmly at the coal market for the next twelve months. Meantime the higher prices obtained for residuals were greatly in their favour. For the past two years several of the shareholders, and many outside, had pressed upon the Directors the desirability of supplying the electric light, as had been done by many gas companies in other places. They considered that the Company could provide the light on better terms than strangers. The income from this would not be great; for Cork was situated differently from other cities. First, the hours of closing the principal warehouses and shops were so early that with these the consumption in the winter would be small, and in summer almost nothing; and, secondly, the electric light being admittedly dearer than gas, and the additional fittings being expensive, it was only the better class of private consumers who could incur the expense, and the greater number of these resided either outside the city, or at such a distance from the centre, that they could not be supplied without loss. To supply underground mains in the central portion of the city, which was subject to occasional floods, would also be very expensive. The principal officer of the Company (Mr. Denny Lane) had made electricity a study for the greater part of a lifetime; and for the last twelve years had carefully watched every development that had taken place in its production and distribution. The Secretary's opinion was, that by gas-engines placed in well-chosen positions in the city, the electric light could be more economically and safely supplied than by any other system. He (the Chairman) might add that some of the most eminent electric light experts whom he had interviewed coincided in this opinion. If this view was correct, it was clear that the Company were in a better position to supply the light than others. The Directors believed that, if the rental from electric lighting was one-tenth of the sum received for gas, it would leave a moderate profit at a price the same as was charged in many larger cities, while under similar circumstances any independent company would incur a loss. To provide capital for the supply of electric light, they would have to obtain an Act of Parliament. In every city where the electric light had been introduced, the consumption of gas had been largely augmented. Of course, they did not propose to take such an important step without having previously submitted the question for the consideration of the shareholders, and obtained their assent; and they should also be fortified by the advice of an electrical engineer. He had ascertained that, in the United States alone, 317 gas companies were supplying the electric light; being more than double the number so engaged two years ago. The gas companies were now supplying close on 5000 large arc lamps, or twice as many as in 1889; and the incandescent lamps amounted to 221,400, being quadrupled in the past two years. Mr. Lynch seconded the motion, which was adopted. A dividend at the rate of 8 per cent. per annum was declared; and the usual votes of thanks were passed.

According to the report of the Directors of the Dover Gas Company, the business is in an extremely satisfactory condition, and the profits earned during the past six months will pay the full parliamentary dividend. They accordingly recommend the declaration of a dividend, at the rate of 7½ per cent. per annum, less income-tax. They also state that, although they cannot report any material improvement in the coal market, they have been able to make arrangements for the ensuing year's supply at prices somewhat lower than those of last year's contracts. The income of the Company for the half year amounted to £16,347; and after meeting the usual expenditure, a balance remains of £2742. The balance-sheet shows a disposable balance of £3485.

The annual meeting of the Faversham Gas Company was held last Wednesday. It was reported that the profit for the year, after providing for income-tax, amounted to £1471, as against £2318 for the year ended June 30, 1890; the difference of £847 being more than accounted for by the greatly increased cost of coal during the past year. This profit of £1471, added to £628 the net balance brought forward from last year, and the interest on investments £51, made £2150 available for distribution, out of which the Directors recommended the declaration of a dividend of 7 per cent., free of income-tax, which would absorb £1881, and leave a balance of £268 to be carried to the next account. The business done during the year showed a considerable increase. The Directors also reported that during the past year they had extended the retort-house and erected a bench for three additional beds of retorts, and replaced about 1100 yards of mains with new ones of larger sizes. A considerable portion of the outlay had been chargeable to revenue account. The report was adopted unanimously.

The annual meeting of the Kendal Gas and Water Company was held last Tuesday; the Chairman (Mr. W. D. Crewdson) presiding. From the report it was shown that the amount of gas consumed during the year was 43,108,700 cubic feet, as against 38,970,000 feet in the previous year; being an increase of 4,138,700 feet. The water-rental amounted to £2725; being an augmentation of £57. The net profit on the year's working was £3758, allowing a dividend at the rate of 5 per cent., and carrying £570 to the credit of the reserve fund, which now stands at £2465. The report was adopted.

The half-yearly meeting of the Kettering Gas Company has lately been held. In their report, the Directors informed the shareholders that by the Kettering Gas Act, 1891, the limited Company was abolished; and a Company under the usual parliamentary regulations established in its stead. During the last six months the consumption of gas had increased about 10 per cent. over the corresponding period of the previous year; but the high price of coal and all other materials used in gas manufacture had continued throughout the half year. It was also found, during the last winter months, that the plant was barely sufficient to keep up the supply, and they had in the present half year made some extensive alterations in the retort-house and the mains, and would have in the next half year to extend their storeage power, so as

to improve the supply; and as these works were for the greater part chargeable to revenue, the profits for the six months had been proportionately reduced. The Directors recommended the payment of the usual dividend of 11½ per cent. on the "A" shares, and 8¼ per cent. on the "B" shares, free of income-tax. The revenue account showed returns to the extent of £5950, and expenditure amounting to £4413; the balance being £1536. After the report of the Directors and balance-sheet had been adopted, the first meeting of the new Company was held. Resolutions were passed authorizing the Directors to convert the whole of the present share capital of the Company into stock; to raise from time to time a sum of money not exceeding £15,000; and to purchase a piece of land adjoining the Company's works.

The Directors of the Morecambe Gas Company, in their annual report, are able to announce a continued increase in the consumption of gas, both for public and private lighting. During the present season, in fact, the consumption has been so large as to severely tax the producing power of the works. The Directors are therefore compelled to recognize the necessity of extending the retort-house and providing further storeage accommodation. The cost of the works required for these purposes will be debited to capital account. As this account is already overdrawn, the Directors propose, in the course of the coming year, to issue a portion of the additional shares authorized by the Company's Act. During the past year, the Directors have put down plant for the manufacture of sulphate of ammonia. The profit on the working of the year, after the payment of mortgage interest, income-tax, &c., amounts to £1992. To this must be added the balance from last year of £670; making an available balance of £2663. Out of this an interim dividend of 4½ per cent. was paid on March 1 last, amounting to £846. The Directors now recommend a further dividend of 5½ per cent.; making with the interim dividend 10 per cent. for the year, free of income-tax. This will absorb £1100; and leave a balance to be carried forward of £717.

The half-yearly meeting of the shareholders of the Newport Gas Company has recently been held. In proposing the adoption of the Directors' report, the Chairman (Mr. E. J. Phillips) said the accounts for the past six months were certainly much better than for the previous half year. Unfortunately there was an adverse balance represented by £508, which had to be drawn from other sources to pay the full dividends. In the preceding half year, however, in order to pay the dividend, a sum of £1300 had to be drawn from the profit and loss account. The cost of coal and labour had greatly increased. An additional sum of £2200 had been paid for coal during the half year, as compared with the corresponding period of 1890. Alluding to the electric light, the Chairman said it was much better that this should be in the hands of the Corporation than of a private Company; because the latter might use it to the detriment of the public interest. The good sense of the Corporation, if they had recourse to it, would lead them to put the ratepayers to the least possible expense. However, if they did adopt it, he thought it must be at a heavy cost to the ratepayers, as in the case of Bradford and other towns. During the half year an extra 643 tons of coal were consumed; and an additional 6¼ million cubic feet of gas were manufactured. The report was adopted; and the usual dividends were declared. A vote of thanks was passed to the Secretary (Mr. E. F. Marfleet) and the Engineer (Mr. T. Canning), and also to the Chairman and Directors.

At the meeting of the Reading Gas Company to-day, the Directors will report that the management of the works, under the supervision of the Company's Engineer (Mr. E. Baker, C.E.), has continued to be of a most satisfactory character. During the past half year, the efficiency of the works has been fully maintained; and the contracts for the year's supply of coal have been entered into upon terms slightly more favourable than those of the year preceding. The staff at the central office has been reorganized, and, as the Directors anticipated, has proved highly advantageous; and they have much pleasure in recording their opinion that the work of that department has been very ably conducted by the Secretary (Mr. A. H. Cane) and the officials acting under him. It is seen by the revenue account that the income of the half year amounted to £26,258; and the expenditure to £21,496—leaving a balance of £4762. The amount available for dividend at the profit and loss account is £14,267; and out of this the Directors recommend the payment of the full dividends.

At the recent half-yearly meeting of the Rochester, Chatham, and Stroud Gas Company, it was reported that the undertaking had, during the past half year, been fairly successful. The result of the increased cost of coals had been a reduction of the profit balance to somewhat below the usual amount—rendering it necessary to draw a little from the unappropriated balances of former years for the purposes of dividend. The Company had, however, now made a contract for coal on much more favourable terms; and the Directors believed they would have no difficulty in continuing to supply gas at its present price. A new gasholder at Rochester could be brought into use whenever needed. A dividend was recommended at the rate of 10 per cent. per annum on the "A" and "D" shares, and of 7 per cent. on the "B" and "C" shares. The report was adopted, and the dividend declared.

The report submitted at the recent annual meeting of the Salisbury Gaslight Company stated that the profit and loss account showed that after paying all liabilities and interest on debenture stock, the net profit for the year amounted to £1441. To this must be added the balance from the previous year's account, of £435, which gave a total of £1877. Deducting from this the half year's dividend paid in February (£1085), there remained the sum of £792. The Board recommended the payment of the usual dividend on the respective share issues, for which purpose it would be necessary to take from the reserve fund the sum of £292. The report was adopted.

The Directors of the Sheffield Gas Company, in the report they will present to the shareholders at the half-yearly general meeting on the 15th prox., state that by the payment of the maximum dividends on the various classes of stock (which will absorb £33,824 out of the £40,580 standing at the credit of the profit and loss account), the reserve fund will not be diminished, but the undivided balance from the half year ending Dec. 30 last will be reduced by £5100. This, they say, shows that the increase which has taken place in the consumption of gas has been insufficient to compensate for the advance in wages, and in the price of coal. The accounts accompanying the report show that the sale of gas produced £89,146; the rental of meters and stoves, £4880; residuals, £42,814; and miscellaneous receipts, £1348—making a total of £138,188. The manufacture of gas cost £91,267 (coals figuring for £52,318); its distribution, £7895; and management expenses were £4936—the total expenditure amounting to £110,946. The balance, £27,242, added to the sums remaining to the credit of the profit and loss account, make up the £40,580 above referred to as being available for the half-year's dividends.

The half-yearly meeting of the Wakefield Gas Company was held yesterday week. The Chairman (Mr. W. Statter), in moving the adoption of the report and accounts, said that the quantity of gas manufactured during the past six months was 114,648,000 cubic feet, which was an increase on the corresponding half of last year of 7,921,000 feet. He believed this increase was partly owing to the very dark and foggy weather which prevailed last winter. The leakage had been 12·29 per cent. Although they had a deficiency of £3500 on capital account, the Directors did not think it necessary to issue any more shares. The Directors paid £6610 for coals during the half year, which was £1911 more than in the corresponding half. The income from gas was £1466 more, from coke £524 more, and from residuals £456 more. The total income for the past half year was £17,707, which was £1939 more than a year ago, and the balance of profit was £5822, which would enable them to pay the usual dividends, and have a surplus of £619. Mr. Haigh seconded the motion, which, after discussion, was carried. Subsequently a dividend at the rate of 11½ per cent., free of income-tax, was declared.

Last Thursday week, the half-yearly meeting of the Weymouth Gas Company was held, at which the Directors reported that, notwithstanding certain unfavourable circumstances which had been operating during the past six months, the business of the Company had been worked satisfactorily, and had resulted in an average profit. A larger output of gas had, of course, resulted in an increased gas-rental, and the receipts from other sources were in excess of those for the corresponding period of last year. The increase in expenditure, however, more than equalled the increase on the other side; so that the balance of the revenue account was somewhat less than it was in the previous year. The balance at the credit of the net revenue account was £2744; and out of this the Directors recommended the payment of a dividend for the half year at the rate of 10 per cent. per annum on the ordinary "A" stock, and 7 per cent. on the ordinary shares, subject to a deduction for income-tax. The Chairman (Mr. R. Thomas), in moving the adoption of the report and accounts, remarked that he did not know they had anything to regret as to the state of their accounts, saving that they were still subject to a large increase in the cost of coal. The additional cost for the half year was in round numbers about £700; so that the shareholders could see what a serious inroad it made upon their profits, and prevented the fulfilment of the long-expressed desire on the part of the Directors—a further reduction in the price of gas. The report was adopted; and the dividends recommended were declared.

A very satisfactory report was submitted to the shareholders of the Yeadon and Guiseley Gas Company last Wednesday. It stated that during the year ended June last 52,113,000 cubic feet of gas had been sent out, as compared with 50,369,000 feet in the preceding year—an increase of nearly 2,000,000 feet. In 1871 the amount of gas consumed was 13,000,000 feet; so that in twenty years the Company's business had become four times as large. The total receipts for the half year amounted to £5075, whilst the expenditure had been £3809, leaving a profit of £1266, out of which the Directors recommended dividends of 10 per cent. and 7 per cent. per annum on the original stock and new shares respectively. This would absorb £1202 and leave £64 to be carried forward. The average cost of coal, of which 3168 tons had been used (as compared with 2970 tons in the previous year), was 14s. 8½d. per ton, this being an increase of 1s. 8½d. per ton on the price paid last year. The report and accounts were adopted, and the dividends named were declared.

Water Companies.

The shareholders of the Chatham, Gillingham, and Rochester Water Company have held their half-yearly meeting. The report showed that the receipts for the six months had amounted to £8029; and a dividend was recommended at the rate of 10 per cent. per annum. The report was adopted.

During the half year ending June 30 last, the Maidstone Water Company received by way of rental the sum of £4006. The profit amounted to £1871; making a sum of £5226 at the credit of the profit and loss account. In their report, the Directors stated that the Maidstone Urban Sanitary Authority had offered £130,000 for the Company's property; but the Board, not considering this offer one that it would be advisable for the shareholders to accept, had replied to that effect. At the meeting of the shareholders last Thursday week, the report was adopted; and it was agreed to declare dividends (free of income-tax) of 4¼ per cent. on the 10 per cent. shares, and of 3 per cent. on the 7 per cent. shares. These payments, it was stated, would absorb the sum of £1832, and make the dividend for the past year on the 10 per cent. shares 8¾ per cent., as against 8¼ per cent. for the previous year, and on the 7 per cent. shares 6¼ per cent., as against £5 17s. 6d. per cent. In the course of the proceedings, it transpired that the Directors had, just before the meeting, received a further communication from the Local Authority as to the purchase of the Company's property; but as they had not had time to consider it, they could not place it before the shareholders.

Sales of Shares.—At a recent sale of shares by auction at Wakefield, 28 £25 original shares in the *Wakefield Gas Company* were sold for £62 10s. each; 99 £5 original shares realized £12 2s. 6d.; and 48 £5 "B" shares produced £10 apiece.——Last Wednesday 46 £10 shares in the *Barnsley Gas Company* were sold by public auction at Barnsley for £15 15s. each.——On the following day some "B" shares (paying 10 per cent.) in the *Eastbourne Gas Company* were sold locally at £20 and £20 2s. 6d; and several "C" shares (paying 13 per cent.) realized prices varying from £25 15s. to £26.

METROPOLIS WATER SUPPLY.

The Quality of the Water in July.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 193,615,074 gallons, as compared with 185,949,769 gallons in the corresponding month of 1890; being at the rate of 32 gallons per head of the population. Of the entire bulk of water sent out, 98,092,605 gallons were drawn from the Thames, and 95,522,469 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·9; Colne Valley, 1·3; New River, 1·4; Tottenham, 1·6; East London (deep-well), 2·1; West Middlesex, 2·4; Chelsea and East London (river supply), 2·5; Southwark and Grand Junction, 2·6; and Lambeth, 2·7. The water abstracted from the Thames by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies had much improved in quality since June. It was efficiently filtered by all the Companies before delivery. The water taken chiefly from the Lea by the New River Company again ranked with the deep-well waters in respect of organic purity, while that of the East London Company from the same source was about equal to the best of the Thames-derived waters. Both supplies were efficiently filtered before delivery. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were all of good quality for dietetic use; and the Colne Valley Company's water, having been softened before delivery, was rendered suitable for washing. All these waters were clear and bright without filtration. Seen through a stratum two feet deep, the Kent, Colne Valley, and Tottenham waters were clear and colourless; the New River and East London (deep-well), clear and nearly colourless; and the remaining waters, clear and very pale yellow. The bacteriological examination by Dr. Koch's process of gelatine plate culture gave the following results: One cubic centimetre of each water collected in sterilized vacuous tubes, on the same days as the samples for chemical analysis, developed the following numbers of colonies of microbes: Grand Junction and Kent, 34; New River, 38; East London (river supply), 54; Lambeth, 58; Chelsea, 60; West Middlesex, 90; and Southwark, 104."

Messrs. Crookes, Odling, and Tidy, in their report for the past month on the composition and quality of samples taken daily of the water supplied to London, say: Of the 186 samples examined, the whole were found to be clear, bright, and efficiently filtered. The character of the water supply to the Metropolis during the month of July was in all respects satisfactory; the proportion of organic matter present in the water being below even the exceptionally small amount recorded in the month of May. There was not found to be any appreciable difference in character between the water distributed by the five Companies taking their supply from the Thames, and the water distributed by the East London Company, who take their supply from the Lea; but what slight difference was found to exist, was in favour of the Lea-derived water, as shown in the following table:—

	Ratio of Brown to Blue Tint. Means.	Oxygen required for Oxidation. Means.	Organic Carbon per 100,000 Parts. Means.	Organic Carbon per 100,000 Parts. Maxima.
Thames supply—				
Mean of previous four months	13·0 : 20	0·051	0·147	0·209
May	9·6 : 20	0·042	0·136	0·150
July	8·9 : 20	0·046	0·121	0·142
Lea supply—				
July	8·2 : 20	0·041	0·119	0·124

THE CONGRESS OF HYGIENE AND DEMOGRAPHY.

Water Supply and the Self-Purification of Rivers.

In the article on "Water and Sanitary Affairs" in the JOURNAL last week, we noticed the papers on the above subjects read by Mr. A. R. BINNIE, M. Inst. C.E., and Dr. PERCY F. FRANKLAND, F.R.S., in the Engineering Section of the Congress of Hygiene and Demography recently held in London. The paper of the first-named gentleman was as follows:—

A good water supply, forming as it does the basis of all our modern sanitary science, is deserving, in a meeting such as the present, of the most careful consideration. And in the forepart of our inquiries on the subject it cannot be denied that, however obtained and however treated from an engineering point of view, we must in the first instance obtain a water of good quality and unimpeachable as to purity. At first sight, this may appear almost a truism; but, unfortunately, we do not find it to be either universally admitted or always observed in practice. For this we have to look to the great and almost general result of our modern modes of life and civilization, which tends more and more to aggregate our population towards large centres of wealth and industry; and these we observe are generally situated on the banks of important rivers, or in river valleys not far distant from tributary streams.

Not only are thickly inhabited areas in themselves altogether improper sources of water supply, but they are also directly the cause of pollution to the streams and rivers which flow through them. Consequently, we find many of the large towns of Great Britain which are governed by municipal corporations—such as Glasgow, Edinburgh, Lancaster, Manchester, Liverpool, Halifax, Bradford, Leeds, Belfast, Dublin, and many others—resorting at considerable expense to uncultivated mountain tracts, almost uninhabited, and bringing the water from great distances, so as to obtain a pure and uncontaminated supply. When, therefore, we occasionally see large towns and cities which have not considered it necessary to take these precautions or to incur the consequent expense, but still continue to drink the water of rivers largely polluted by the more or less clarified sewage and the manure of populous areas, we are led to ask ourselves the question whether the large expenditure of capital that has been incurred in certain cases to obtain a pure water supply has not been an entire waste of our resources. There can be little doubt that human beings can, for a considerable time, drink with impunity water largely contaminated with the excreta, both solid and fluid, of healthy persons; and that they are able to do so with impunity, and without loathing and disgust, appears to be due to ignorance and apathy on the part of the water consumers, and to the power rivers possess of apparently destroying and veiling the more gross and palpable polluting substances.

There are some persons, no doubt, who teach that running water has the power of entirely destroying sewage and other polluting matter which may pass into it. But there are few, let us hope, who would say that we can with safety drink water which has been polluted with the excreta of persons suffering from cholera, typhoid, smallpox, and similar diseases. And yet this is practically the position taken up by those who advocate, unreservedly, the propriety of deriving supplies of drinking water from rivers on the banks of which, at no great distance, are situated large towns; for sooner or later we must expect epidemics to arise, even under the most careful management.

Of two facts we may feel quite confident—(1) that water subject to pollution is a very potent factor in the spread of disease; (2) that there is perhaps no better mode of introducing into the human system any substance it can absorb than by drinking it in the form of a solution. This being the case, it almost follows as a natural consequence that the utmost care should be taken to guard our supplies of drinking water from contamination; and yet we see persons around us who shut their eyes to observed and well-known facts, and speak of the teaching of science and the experience of the world as "sentiment," and who continue to force upon a large number of their fellow-creatures supplies of water contaminated with the excreta of millions of men and animals. That wells are frequent sources of death and disease, due to their contamination by house drains, is too patent to need a word of remark; and yet it required the cholera outbreak of 1849, and the death of some thousands of persons, to impress the fact on the people of London. And it appears to be forgotten that to drink the river water polluted by sewage cost London, in the cholera outbreaks of 1854 and 1866, the deaths of more than 16,000 persons.

That people will go on for years persistently drinking water that is contaminated by infiltration from graveyards, notwithstanding frequent warning, is proved by the outbreak of enteric fever in 1888 at Cradley, which caused 16 deaths in 113 cases. The case of Lausanne, in Switzerland, in 1872, proves that typhoid fever can be commenced by spring water flowing miles underground from a neighbouring valley. The cholera outbreak in Spain in 1885 showed that generally the disease passed down the valleys, decimating the towns which drew their water from the rivers, but passing those which were independent of the rivers, and had pure and uncontaminated supplies. In India the author has seen a town in which cholera had become endemic, almost entirely freed from that dire disease, simply by giving up the water supply derived from a popular drainage area, and resorting to a purer and uncontaminated source. And the outbreak last year of enteric fever in the districts of Stockton and Middlesbrough and Darlington, which derive their water supply from the River Tees, proves that the germs of that disease are not destroyed in their passage for upwards of 13 miles down that river from Barnard Castle.

In all these cases chemical science is of little help, as it fails to detect the germs of disease. It can tell us of the presence of organic matter; but without a careful inquiry into the previous life-history of the water, it cannot pronounce that, under all circumstances, it is a safe and pure drinking water. Nor, from the experience of Valencia in 1885, can we place much dependence on sand filtration as an effectual preventive of disease. Sand filtration may arrest the living germs, but is apparently unable to stop the passage of the minute spores from which they spring. The precipitation and clarification of sewage effluent by chemical agency also can hardly be relied upon, as it merely abstracts about one-fifth of the more solid impurity, leaving four-fifths of the dissolved organic matter to flow off into the river. What, then, are we to expect from the continuance of supplies to large cities from sources so polluted, but that such cities may go on for years, perhaps, boasting of the chemical purity of their water and their low death-rate, forgetting that the constitutions of their water consumers are being gradually prepared, by continually drinking small quantities of diluted sewage, to receive the germs of some violent epidemic which sooner or later will visit the sources of supply; and then will follow such an outbreak of death and disease as will cause consternation throughout the land.

The following are the principal portions of the paper read by Dr. Frankland:—

There is, perhaps, no controversial matter connected with the hygiene of water supply to which engineers have so frequently had their attention directed as that of the self-purification of river water. Although it is a subject on which most water engineers have a very decided opinion, the present occasion appears to be particularly favourable for reviewing the whole question by the light of the most recent information, especially as we have the benefit of the presence of a number of distinguished colleagues from abroad, whose opinions on this much vexed topic will be very welcome.

The subject of the self-purification of rivers admits of being considered from two perfectly distinct points of view, as indeed do almost all other questions relating to the purity of water—viz., from the chemical and the biological aspects. Inasmuch as the organic impurities (and the controversy, of course, only refers to organic impurity) gaining access to rivers may be either devoid of life and unorganized, or living and organized, their discussion is in the one case a chemical, and in the other a biological question. Until recently the subject has been only discussed from a chemical point of view, in consequence of

the impossibility which formerly existed of obtaining any precise or accurate information upon such matters of biology.

The firm conviction possessed by many that rivers undergo spontaneous purification in the course of their flow is generally based upon personal observations made upon streams, in which the process appears to be going on in such a striking manner that no analytical evidence is required. All engineers are acquainted with streams which are visibly polluted at one spot, and apparently pure a few miles lower down. When such cases are further submitted to analytical tests, the latter, of course, fully confirm the previous ocular impressions. In fact, that such disappearance of organic matter does take place is beyond all shadow of a doubt; and it is mere waste of time to contest it. A bag full of feathers shaken into the air at one spot would similarly be imperceptible a few hundred yards away. That the polluting matter has been destroyed, however, in the course of a few miles flow is almost as improbable as that the feathers should have been decomposed in their short flight through the air. In fact, when these cases of supposed self-purification are carefully investigated, it becomes very doubtful whether the phenomenon is due to anything beyond dilution and sedimentation. The careful experiments which have been made to test this point are by no means numerous.

A series of investigations was made by the Rivers Pollution Commissioners of 1868 to test the point, both as regards highly polluted streams, such as the Irwell, Mersey, and Darwen, and comparatively pure ones like the Thames; but in both cases their results were of a negative character, and pointed to no real purification—*i.e.*, destruction of organic matter—although there was distinct evidence of considerable improvement in the quality of the water through sedimentation. Some years ago, I undertook a series of experiments to further test the matter in connection with the Thames, which has always been regarded by some as a river possessed of most remarkable self-purifying power, and which undoubtedly often does reach London after a long flow through a cultivated and fairly populated district, in a surprisingly pure state. The experiments in question consisted in taking samples of the water flowing in the river at different points on the same day, with a view to establishing whether, on the whole, the chemical quality of the water was improved or deteriorated during the course of its long flow. Thus, on one day, samples were taken at Oxford, Reading, Windsor, and Hampton; on another day at Chertsey and Hampton; and on three different occasions, samples were collected both at Windsor and at Hampton on the same day. The results of analysis clearly indicate that the chemical quality of the water undergoes slight but almost continuous deterioration in flowing from Oxford to Hampton. It must be remembered that this deterioration is in spite of a very large increase in the volume of water, a considerable proportion of which gains access to the river from springs in the chalk, and is of the very highest purity. Thus, Mr. Thornhill Harrison, C.E., has determined that the total daily increase in volume in the Thames between Maidenhead and Thames Ditton was (exclusive of the Colne, Wey, and Mole), in April, 1884, 249,500,000 gallons; on July 8, 1884, 49,000,000 gallons; July 22 to 26, 131,000,000 gallons; and November, 1890, 45,000,000 gallons.

In the experiments I purposely limited the scope of my inquiry to the dissolved organic matter, so as to avoid the complications arising from the suspended matters, concerning the removal of which by sedimentation there is no dispute. On this account all the samples were filtered through Swedish paper before analysis. Indeed, it cannot be too strongly pointed out that, unless the questions of dissolved and suspended matters are kept wholly distinct in these investigations, no reliance whatever can be placed upon the results. The idea of any striking destruction of organic matter during the river's flow receives no sort of support from my experiments; the evidence is, in fact, wholly opposed to any such supposition. I have also had an opportunity of making a somewhat similar experiment on the flow of the Ure and Ouse above York; and in this there is not the slightest support to the theory of self-purification. Nor is there any diminution in the number of microbes during the observed flow.

Of foreign investigations on the same subject, there are those of Hulwa, on the Oder at Breslau; of Frank, on the Spree at Berlin; and of Prausnitz, on the Isar at Munich. Of these investigations, Hulwa professes to have traced the complete purification of the Oder from the sewage of Breslau after a flow of 32 kilometres. It is impossible to make any use of these results without a knowledge of the changes which the volume of water in the river undergoes during this flow. A most complete account of the condition of the Spree during its flow from Berlin to Potsdam is given by Frank; full account being taken of the changes in volume during the course. The results arrived at by Frank are, however, very different from those of Hulwa; for the former maintains that the change in chemical composition is very insignificant throughout, but that the number of microbes undergoes a most striking diminution during the flow—a result which he naturally attributes to sedimentation. Already, in 1885, I had myself shown to what an astonishing extent micro-organisms are removed in the subsidence of solid particles. This I had proved, not only in the case of laboratory experiments made with the most varied materials, but also on the large scale in the softening of water by Clark's process. The disappearance of the microbes in the water of the Spree during its sluggish flow through the lake-like extension which it forms after junction with the Havel at Spandau, above Potsdam, is obviously due to causes of a similar kind. In the experiments of Prausnitz on the Isar at Munich, there is the same disappearance of microbes during the flow, which is again attributed to sedimentation.

A careful study, therefore, of these most recent investigations leads us to the inevitable conclusion that sedimentation is the main cause of any self-purification in river water. Of any rapid oxidation of dissolved organic matter, there is still no reliable evidence, although, of course, dilution, which frequently takes place on the largest scale, as in the case of the Thames, without being suspected until made the subject of a most careful scrutiny, will produce a superficial appearance of such a result. This removal of microbes by sedimentation during the flow of a river is unquestionably of great hygienic importance, and of much greater hygienic importance than the alleged oxidation of dissolved organic matter, which in itself can have no power of communicating zymotic disease. It is, however, a process which cannot be relied upon as furnishing any guarantee that harmful microbes, turned into a stream at a given point, will no longer be present in the water at any point lower down.

From the numerous experiments which have been made on the vitality of pathogenic microbes in water, there can be no doubt that many forms which might have subsided as above indicated, would remain alive for long periods of time, and be carried down uninjured when the river was next in flood. Indeed, recent experiments of Lortet, have shown that such deposits formed in lakes actually, and not unfrequently, contain pathogenic forms in a state of vitality.

We must not, therefore, allow this sedimentation of microbes to cause us to relax our protective measures to exclude contamination from our streams. On the contrary, bacteriological research clearly indicates, on the one hand, the value and importance of purifying by the very best available means all dangerous liquids, such as sewage, before admission into rivers, and, on the other hand, to submit the water drawn from streams for town supply to the most careful subsidence and filtration through sand before delivery.

NOTES FROM SCOTLAND.

From our Edinburgh Correspondent.

EDINBURGH, *Saturday.*

The holiday season is upon us; and there is little to record. This is an off-month with most of the controlling bodies of gas undertakings. Those of them who do meet, transact merely formal business—such trifling things as the manager's report as to output and quality, and the appointment of visitors to the gas-works for the month. In this dearth of news, I am obliged to descend to the chronicling of items which ordinarily would be passed by. Scotland is at present teeming with tourists who have come north to look on her rugged scenery; while (such is human nature) her own sons and daughters have gone south, "to see life." I have been led into this train of thought by the fact that yesterday morning, in Waverley station at Edinburgh, I stumbled upon Mr. Valon, of Ramsgate, the President of The Gas Institute, who was returning home after a brief holiday in the Trossachs, whither he had repaired after the meeting of the North of Ireland Association of Gas Managers in Belfast. Mr. Valon is the second gas manager from south of the Border whom it has been my pleasure to meet in the same place this summer; and I shall be delighted to see as many more as may choose to come.

Having stated in my "Notes" last week that gas affairs in Forfar were not quite satisfactory, it gives me the greater pleasure to record that the output of gas during the month ending the 17th inst. showed an increase of 209,000 cubic feet over that of the same period last year. This is a good beginning for the year; and it is to be hoped the monthly reports will all be equally satisfactory.

That the gas coal trade is in a very flourishing condition just now is attested by the annual report of the Rosewell Gas Coal Company, which states that the gross profit on the transactions for the year ending June amounted to £8790. After deducting £2071 for depreciation, paying a dividend of 20 per cent. on the paid-up capital, and further crediting the reserve fund with £1000, there is left to be carried forward a balance of £1058. The opening up of Lassodie Mill Colliery is being pushed forward; and it is expected that the present daily output of 50 to 60 tons will be increased the next three months to 150 or 160 tons.

It is stated (although their report has not yet been issued) that the Consulting Engineers of the Edinburgh and District Water Trust have recommended that the Manor Water Scheme should be adopted for augmenting the water supply, at an outlay of nearly £800,000. The Manor is a stream of the very purest water, which flows into the Tweed about a mile and a half above Peebles. The head waters of the stream are proposed to be impounded, with a gathering-ground consisting largely of mountains rising from 2000 to 2600 feet in height. A reservoir is to be formed at Posso, where a mound in the centre of the valley can be taken advantage of to strengthen the embankment. Into this reservoir the water of no fewer than 130 springs will flow. The gathering ground will embrace an area of 13,720 acres, which—with an estimated rainfall of 26 inches on the average of three dry seasons, and making ample allowances for compensation—will afford the city and district 15 million gallons per day for town supply. This will practically double the whole existing supply from the Pentlands and Moorfoot. It represents a supply for a population of 800,000—more than double the present population of the city and district. Posso reservoir will have an area of about 235 acres, and a storeage capacity of 2700 million gallons. The water will be conveyed to the service reservoir at Alnwickhill by a conduit 25 miles in length, of which 4 miles will be in tunnel. The tunnel it is proposed to construct will not only carry the maximum quantity of water from the Manor Valley, but also, if it should become necessary in the distant future to convey an additional supply, either from St. Mary's Loch or the Tweed.

From our Glasgow Correspondent.

GLASGOW, *Saturday.*

The statement of the Ardrossan Corporation gas accounts for the year 1890-91 shows that the income amounted to £2296. Of this sum consumers by meter contributed £1571; from the Harbour Company £212 was received; the receipts from the public and private lamps amounted to £193; the meter hires ran up to £43; and for tar, liquor, coke, and lime, the sum of £275 was realized. There was brought over from the previous year's accounts a balance of £187—making in all an income of £2482. For coal, lime, wages, and general maintenance, the year's expenditure amounted to £1462; for interest and money borrowed the amount was £552; and sums, amounting together to £180, were made on account of repayment of capital and credited to the sinking fund account. Collectively, these various payments run up to a total of £2194; so that when the year's accounts were made up there was a credit balance of £287 to carry forward. This shows an improvement to the extent of about £102 on the year's working. The acquisition of the gas supply of the town by the Burgh Commissioners has thus proved to be a decided advantage to the gas consumers. A solid addition has been made to the salary of the Gas Manager; and it has been resolved to continue the price of gas at last year's rate.

A marked improvement has also been made in the position of the gas supply undertaking of Gourock, which has now been in the hands of the Burgh Commissioners several years. The total receipts for the past year were £2878. From the sale of gas by meter and for public lamps, &c., the income was £2416; the rental of meters realized £56; and that of gas-stoves, £16. For residual products an income of £366 was derived; and for service-pipes, fittings, and miscellaneous matters, there was an income of £24. The outlay for the manufacture of gas was £1694; for distribution of gas, it was £181; the rates, taxes, and insurance mounted up to £125; the management cost £127; for interest and repayment of loans and bank interest the expenditure came to £470; and the bad debts appear in the accounts at £17. The total was thus £2617; so that there was a balance of profit amounting to £261. At the close of the preceding year's account there was a balance of £378.

There has been another dull week in the Glasgow pig iron market. Prices have fluctuated but slightly. At the close yesterday, Scotch warrants were at 47s. 2½d. per ton, cash buyers. Cleveland iron was then at 39s. 3½d.; and hematite iron at 48s. buyers.

Business in the Glasgow coal trade this week has continued on the "even tenor of its way," although in some cases sellers have been less eager to press their coal on the market. The export demand has again been fairly good, and freights have been easier to obtain. Main sorts are a trifle under 8s. per ton. Splint has shown a falling off in demand, which is not surprising, considering the slackening in the iron and steel centres. The ruling quotation this week has been 8s. 9d. to 9s. per ton f.o.b. Steam descriptions are unchanged from last report. In Ayrshire, the improvement established some days ago is maintained. Household coal is to be raised 1s. per ton next month; consequently, merchants are stocking their depôts.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 22.

Sulphate of Ammonia.—The market remains firm; and if the actual spot business is not great, it must be considered due to the small quantities offering at the present moment. Meanwhile, full prices are being paid for urgent parcels; and £10 17s. 6d. has been obtained both here and f.o.b. Hull, while at the latter port it is questionable whether anything could now be bought under £11. The forward demand is not quite so active, although the doings in nitrate lead to the anticipation of enhanced values in that commodity, and consequently in sulphate.

LONDON, *Aug.* 22.

Tar Products.—The improvement in benzols is not maintained, although for spot delivery 4s. 3d. for 90's, and 2s. 10½d. for 50's might be obtained. There is no benzol offering, nor are there any urgent buyers at the moment. Creosote and other tar oils are unquestionably weaker; and having regard to the time of the year, this is somewhat singular. Important inquiries, however, are in the market from abroad, which, if concluded, will materially reduce the stocks in makers' hands. Pitch is inquired for; but most makers are sold to the end of the year; and no large business is reported. This article is healthy; and it is now hoped that, notwithstanding the lower price of coal, its value will remain for at least the next season. Numerous causes have conspired to bring about this position: but there is no doubt the comparatively new field for pitch in Germany, as well as the American demand, has a good deal to do with it. Carbolic acid is dull; and the same may be said of anthracene and the other tar products. Important tar contracts in the country have been concluded at 24s. to 25s. Products are quoted as follows: Pitch, 33s. to 34s. 6d. Benzol, 90 per cent., 4s. 3d.; 50 per cent., 2s. 10½d. Toluol, 1s. 6d. Solvent naphtha, 1s. 3d. Crude naphtha, 1s. 2d. Creosote, 1¼d. Carbolic crystals, 5d.; crude, 60's, 1s. 2d. Cresol, 8d. Anthracene, "A" quality, 1s. 3d.; "B" quality, 11d.

Sulphate of Ammonia.—The market continues quite robust; and buyers are more numerous. Business is reported at £10 15s. to £10 17s. 6d., both for prompt and short forward delivery; while for October-March, £11 5s. is spoken of. The stocks in makers' hands are low; and, from appearances, the price will not only be maintained, but before the end of September will be considerably improved. Gas liquor is quoted at 4s. to 5s.

THE LANCASHIRE GAS COAL TRADE.

From Our Own Correspondent.

So far as all the better qualities of coal and fuel are concerned, a very steady tone is still maintained throughout this district; and with regard to house-fire qualities, any tendency in the market is certainly in an upward direction. The quantity of coal going into stock for winter requirements is still in most cases considerably below the average; and there is consequently the possibility of some scarcity of supplies in the event of any large demand for winter consumption. Naturally, colliery proprietors will be cautious about any advance in prices which would tend to unsettle the men; but where concessions—and these for the most part have been very small—have been made upon winter rates during the last month or two, it is more than probable that with the close of the month there will be a return to maximum list prices. At the pit's mouth, best Wigan Arley coal is not quoted lower than 12s. to 12s. 6d. per ton; second qualities, 10s. 6d. to 11s.; Pemberton four-feet, 10s. to 10s. 6d.; and common house-fire coals, 9s. to 9s. 6d. The slackening activity in many of the principal coal-using industries, and the holiday stoppages of works in most of the Lancashire manufacturing districts which take place at this season of the year, are necessarily to a considerable extent affecting the demand for steam and forge coals and engine classes of fuel; supplies of these being in excess of requirements. Upon steam and forge coals there is some slight easing down in prices; colliery proprietors in many cases having to make concessions upon their list rates to meet the competition of surplus supplies now in the open market. But this, for the most part, is only for temporary sales; and there is no disposition to contract forward at lower prices. At the pit's mouth, ordinary steam and forge coals could now be bought at about 7s. 6d. to 8s. per ton, although 8s. 3d. is quoted in many cases. For shipment the demand has been showing rather more activity, and prices are perhaps not quite so weak as they have been of late; but, delivered at the Garston Docks or the High Level, Liverpool, ordinary steam coals can still be bought at 9s. to 9s. 6d. per ton, but the better qualities average about 10s. per ton. The weakest point in the market is, however, in engine classes of fuel, particularly the inferior descriptions. The better sorts are mostly moving off moderately well. Common descriptions of slack are, however, pushed for sale at almost any figure; and buyers prepared to take quantities for prompt delivery are able, in many cases, to almost fix their own prices. At the pit's mouth, burgy averages about 6s. 6d. to 7s. per ton; best qualities of slack, 5s. 6d. to 6s. per ton; with common sorts readily obtainable at 3s. 6d. up to 4s. per ton.

Northern Coal Trade.—The coal trade of the north-eastern district is still very firm; and there is now a larger demand for gas coal showing itself. In best Northumbrian steam coal, a rather easier demand is experienced; but the best collieries have full work, and still quote about 12s. 6d. per ton free on board. Small steam coal is very dull, at about 4s. to 4s. 6d. per ton. Gas coal is in increasing demand; both the exports and the home shipments being very heavy just now. The local demand is extending. The price generally asked varies from 9s. 6d. to 10s., free on board; but, of course, the contracts that are concluded are at lower figures. It seems to be the belief that the miners in many of the chief gas-coal producing collieries are restricting the output; and if this is so, gas coal will, in a month or two, be very much more scarce than it now is, because the output is so well taken up even at the present time. Bunker coal is quiet, and is likely to be rather lower in price, as so many steamers are idle. Manufacturing coal is also quiet. In coke there is this week very little alteration.

The Electric Light Installation at Madame Patti's.—Readers of the daily papers will have noticed the announcement of the recent opening of the theatre at Madame Patti's residence, Craig-y-Nos Castle, near Swansea. The theatre, as well as almost every part of the Castle and the winter gardens is illuminated by the electric light, which, as already mentioned in the JOURNAL, has been fitted up by the Wenham Company, Limited; the work having been carried out under the direction of Mr. A. Bergthiel. From the principal dynamo the current is conveyed to 14 accumulators, whence it is drawn for lighting and also for furnishing motive power. There are two independent dynamos, one of which is driven by a gas-engine; an auxiliary dynamo being actuated in the same way. It will thus be seen that ample provision has been made for keeping up a supply of current to the 500 incandescent lamps comprising the installation.

New Railway Communication with the Bury Gas-Works.—Last Wednesday afternoon the ceremony of cutting the first sod of the new railway from the Lancashire and Yorkshire line to the Bury Corporation Gas-Works was performed by Mr. Alderman Burrow the Chairman of the Gas Committee. The new railway is about half a mile in length, with an additional quarter of a mile of sidings. It joins the Lancashire and Yorkshire Railway from Bury to Bolton near to Deardens. The total cost of the work is estimated at £25,000. The contractors are Messrs. Etheridge and Clark, of Manchester. It is calculated that the new line will save about £1000 a year to the Corporation in carting. At the ceremony on Wednesday, the Mayor, on behalf of the contractors, presented Alderman Burrow with a handsome silver spade; and, in doing so, said he wished success to the undertaking. Alderman Burrow remarked that it was twelve years since the scheme was first recommended to the Corporation by the Gas Committee; but difficulties had arisen in carrying it forward. He believed the new siding would not only be of advantage to the gas-works, but to local manufacturers. In the evening the Gas Committee entertained the members of the Corporation at dinner.

The Finances of the Leeds Corporation Gas and Water Departments.—The abstract of the accounts of the Leeds Corporation for the year ending March 25 last has just been issued by the Borough Accountant (Mr. W. Derry). With regard to the finances of the Gas Department, it is stated that the revenue account on the "creditor" side shows that the sale of gas produced £223,687, and the rental of meters and stoves £11,184—making together £234,872; but the estimated discount amounts to £7200, reducing the total to £227,672. The residual products realized £68,336; and small sums for spent oxide, carbon, old metal, and rents increase the total to £297,092. On the "debtor," side it is seen that the cost of the manufacture of gas was £214,553; the distribution of gas, £19,753; rents, rates, and taxes, £5469; management, £3539; rents and leakages, £2700—making the total £246,015. To this has to be added £42,355 for interest; leaving a balance, being the net profit, of £8721. The sum set apart for the redemption of debt is £9739, which swallows up the profit, and leaves a deficiency of £1017. In the Water-Works Department the revenue account shows an income of £97,652. Water-rents amounted to £100,464, less £4091 discount, reducing the figures to £96,372. The expenditure, including £56,662 on interest account, amounted to £75,917; and there was a balance, being the net profit for the year, of £21,734. From this sum £15,146 was set apart for the redemption of debt; leaving a surplus profit of £6587. By a statement showing the position of the capital expenditure in relation to the borrowing powers, it is seen that the expenditure on the gas-works has been £1,126,579; and on the water-works, £1,641,031. The amount of expenditure out of revenue, premiums, &c., on the gas-works has been £7345; and on the water-works, £7113. The expenditure as against the borrowing power on the gas-works has been £1,119,233; and on the water-works, £1,633,918. The borrowing powers of the Gas Department amount to £1,250,000, and of the Water Department to £1,770,000—the sum remaining to be expended as against the borrowing powers being respectively £130,766 and £136,081.

The Electric Lighting Scheme for the City of London.—The Board of Trade have given their consent to the transfer to the City of London Electric Lighting Company, Limited, of the Provisional Orders granted to the Brush Electrical Engineering Company, and the Laing, Wharton, and Down Construction Syndicate, Limited, for the electric lighting of the City.

The Cost of the Wessenden Water Bill.—At last Wednesday's meeting of the Huddersfield Town Council, the minutes presented by the Water Committee contained the record that the taxation of the bill in respect of the costs, charges, and expenses of the Wessenden Commissioners of and incidental to the promotion of the Wessenden Reservoir Bill in 1890, and of their opposition to the Huddersfield Water Bill, had resulted in £2907 being struck off; leaving the sum payable in respect of those charges by the Corporation, £4068.

The Skipton Water Supply.—A public meeting, convened by the Chairman of the Local Board (Mr. J. B. Dewhirst), was held at Skipton last Thursday, for the purpose of obtaining the consent of the ratepayers to a scheme of water supply propounded by the Board, whereby an Act of Parliament was to be obtained granting permission to the local authority to borrow a sum not exceeding £40,000 for the purpose of constructing a reservoir at High Skibeden, and for other purposes of water supply. About twelve months ago an attempt was made to carry a similar scheme; but the present project takes in the Eastby water, which the Ratepayers' Protection Association were so clamorous about. The Board were then defeated at the public meeting, and the Chairman demanded a poll; but the result was that the scheme was rejected. On the present occasion there was a crowded meeting of ratepayers. The Chairman proposed a resolution authorizing the Board to apply for the powers desired; but after an animated discussion, on being put to the vote, it was negatived.

The Position of the Belfast Water Supply.—Notwithstanding the energy that has characterized the Belfast City and District Water Board for some years past, it appears that the supply of water will soon prove inadequate, owing to the unparalleled development of the city and the excessive demands now made for manufacturing and other public purposes. The consumption is now close upon 10 million gallons per day; and the present rate of increase is something like half a million gallons per annum for the twenty-four hours. The water received per day is only about 10½ million gallons; so that, roughly speaking, there is but a margin of half a million between the supply and the demand. The resources of the Trust, it is true, are not wholly exhausted, as by their Acts they are empowered to construct a reservoir at Leathemstown, adjacent to Stonyford, and to further develop the works at Woodburn. These auxiliaries, however, would not help them for more than three or four years. Hence the Board are considering the propriety of further extension; and they have instructed their Engineer (Mr. L. L. Macassey) to report on the present position and future prospects of the supply. It is therefore quite possible that the Commissioners will, at no distant date, be found promoting a Bill of a comprehensive character.

Memorial against the Coventry Gas-Works Extensions.—At the quarterly meeting of the Coventry City Council last Tuesday, Alderman Gulson said he had that morning received by post a memorial from a number of ratepayers in the neighbourhood of the gas-works complaining of the nuisance caused by the works. The memorialists stated that they viewed with much alarm the continual extension of the works in the midst of a populous and rapidly extending portion of the city. The constant smells arising from the gas processes, and the crowding of the works upon the already confined space, made them feel that this development was largely at the expense of their health and comfort, and might easily be carried so far as to constitute an absolute danger to the vicinity. They also pointed out that the area occupied by the present gas-works was unsuitable for further extension, and that more gas could only be produced and stored there by adding to works in the overcrowded space; and they submitted to the most serious consideration of the Corporation the removal of the manufacture of gas to a locality where a maximum of convenience would mean a minimum of danger, loss, and nuisance to a very large portion of the inhabitants. The memorial was referred to the Gas Committee for consideration.

The East Worcestershire Water Company and the Supply of Droitwich.—At the last meeting of the Droitwich Town Council, the Water-Works Sub-Committee reported that, after protracted negotiations, they had arranged with the Directors of the East Worcestershire Water Company for a supply of water to the town under certain terms contained in an agreement. There were two points on which the Committee were unable to agree with the Directors; the first being the question of averaging the daily supply of water to the Corporation, and the second was the question of whether the latter were prepared to bind themselves not to take more than a certain quantity per day. As to the first of these points, the Company's Act of 1877 provided that they should, within twelve months from the receipt of notice from the Corporation, supply the latter with water at the rate of 7d. per 1000 gallons, on their undertaking to take, use, and pay for not less than 50,000 gallons per day for a term of at least 21 years, with a proviso that, if they took more than 50,000 gallons the Company should reduce the charge to 6d. for every 1000 gallons supplied over and above that amount. But the requirements of the Corporation during the bathing season were much more than during the winter months; and the Committee, therefore, endeavoured to persuade the Company to agree to have the amount of water consumed taken once a year, and then averaged, in order to ascertain the daily supply, or failing that to have it averaged each six months, at Christmas and Midsummer. To this certain objections had been made; and the Committee now desired the instructions of the Council upon the matter. The report was discussed in private; the result being that the Council decided that the water should be taken for a term of thirty years, to be extended to sixty years if they required it. Also that the price should be 7d. per 1000 gallons if the supply be under 50,000 gallons per day, and that for every 1000 gallons exceeding that quantity the price should be 6d. The Council further resolved that, if the Company would not give way as to the method of arriving at the daily average consumption, they would not bind themselves to enter into an agreement for a limited supply of water.

Water in Queensland.—The Australian correspondent of the *Engineer* says that water has been struck at a spot 40 miles from Bourke on the main road to the Queensland border. The bore is down 375 feet; the flow of water being 60,000 gallons daily. This is the first water that has been struck by any contractor under the new Water Conservation Department. The Downs Station bore, Queensland, has struck a splendid supply of water at a depth of 698 feet, estimated at 1,600,000 gallons daily; and the Quimbarra bore, at Cunnamulla, has been completed at a depth of 1250 feet. No. 2 bore, at Burrenbulla, has struck a supply of 2,000,000 gallons at 1600 feet. Too much value cannot, he says, be placed on the discovery of water in the arid parts of the interior.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 346.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	17—18	..	5 16 8
100,000	10	,,	7½	Do. 7 p. c.	10	11¾—12¼	..	6 0 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	105—107	+1	4 13 5
100,000	20	28 May	8	Bahia, Limited	20	13—15	..	10 13 4
200,000	5	13 May	7½	Bombay, Limited	5	6¾—7¼	+¼	5 3 5
40,000	5	,,	7½	Do. New	4	4¾—5¼	..	5 14 1
380,000	Stck.	13 Aug.	12½	Brentford Consolidated	100	215-220*	..	5 11 4
125,000	,,	,,	9½	Do. New	100	156-160*	..	5 15 7
220,000	20	12 Mar	11½	Brighton & Hove Original	20	40—42	..	5 9 6
320,000	20	10 Apl.	11½	British	20	41—46	..	4 17 10
50,000	10	12 Mar.	11	Bromley, Ordinary 10 p. c.	10	18—20	..	5 10 0
39,000	10	,,	8	Do. 7 p. c.	10	13—15	..	5 6 8
328,750	10	13 Nov.	6	Buenos Ayres (New) Limited	10	7—8	..	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	90—95	..	6 6 4
150,000	20	13 Aug.	8	Cagliari, Limited	20	24—26*	..	6 3 1
550,000	Stck.	10 Apl.	13¾	Commercial, Old Stock	100	255—265	..	5 3 9
130,000	,,	,,	10¾	Do. New do.	100	190—200	..	5 7 6
130,000	,,	26 June	4½	Do. 4½ p. c. Deb. do.	100	119—124	..	3 12 7
800,000	Stck.	11 June	10	Continental Union, Limited	100	225—235	..	4 5 1
200,000	,,	,,	7	Do. 7 p. c. Pref	100	190—200	..	3 10 0
75,000	Stck.	25 Mar.	10	Crystal Palace District	100	200—205	..	4 17 7
486,090	10	15 July	10	European, Limited	10	20—21	..	4 15 3
354,060	10	,,	10	Do. Partly paid	7½	14¼—15½	..	4 16 9
5,470,640	Stck.	13 Aug.	13	Gaslight & Coke, A, Ordinary	100	233—237*	—1	5 9 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	94—97*	..	4 2 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	254-259*	..	3 17 3
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	118-123*	..	4 1 4
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	172-177*	..	4 4 9
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	159-164*	..	4 5 4
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	250-255*	..	3 18 5
476,000	,,	,,	—	Do. K, 6 p. c. Prf.	100	153-158*	..	3 16 0
1,061,150	,,	11 June	4	Do. 4 p. c. Deb. Stk.	100	112—115	..	3 9 7
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	120—125	..	3 12 4
908,000	,,	,,	6	Do. 6 p. c. do	100	163—168	..	3 11 5
3,800,000	Stck.	13 May.	12	Imperial Continental	100	231—236	..	5 1 9
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4¾—4¾	..	6 6 4
560,000	100	1 Apl.	5	Met. of Melbourne, 5p. c. Deb.	100	111—113	..	4 8 6
541,920	20	11 June	6½	Monte Video, Limited	20	16—17	..	7 12 11
150,000	5	28 May	10	Oriental, Limited	5	8¼—8¾	..	5 14 3
60,000	5	25 Mar.	7	Ottoman, Limited	5	4¾—5¼	..	6 7 3
166,870	10	26 Feb.	2	Pará Limited	10	2¾—3¼	..	—
420,000	100	4 May	6	People's Gas of Chicago— 1st Mtg. Bds.	100	92—97	..	6 3 9
500,000	100	1 June	16	2nd Do.	100	90—95	..	6 6 4
150,000	10	28 Apl.	10	San Paulo, Limited	10	13—15	..	6 13 4
500,000	Stck.	26 Feb	15½	South Metropolitan, A Stock	100	285—290	..	5 6 11
1,350,000	,,	,,	12	Do. B do.	100	235—240	—2½	5 0 0
200,000	,,	,,	13	Do. C do.	100	245—250	..	5 4 0
700,000	,,	26 June	5	Do. 5 p. c. Deb. Stk.	100	141—145	+1	3 9 0
60,000	5	12 Mar.	11½	Tottenham & Edm'nton, Orig.	5	11—13	..	4 8 5
				WATER COMPANIES.				
729,281	Stck.	26 June	10	Chelsea, Ordinary	100	260—265	..	3 15 6
1,720,560	Stck.	10 Apl.	8	East London, Ordinary	100	208—213	..	3 15 1
544,440	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	138—143	..	3 3 0
700,000	50	11 June	8	Grand Junction	50	106—110	..	3 12 9
708,000	Stck.	13 Aug.	10½	Kent	100	265-270*	+2½	3 17 10
1,043,800	100	26 June	9½	Lambeth, 10 p. c. max.	100	234—239	+1	3 19 6
406,200	100	,,	7½	Do. 7½ p. c. max.	100	192—197	..	3 16 2
260,000	Stck.	25 Mar.	4	Do. 4 p. c. Deb. Stk.	100	118—123	..	3 5 0
500,000	100	13 Aug.	12½	New River, New Shares	100	341-346*	..	3 10 1
1,000,000	Stck.	30 July	4	Do. 4 p. c. Deb. Stk	100	123—126	..	3 3 6
902,300	Stck.	11 June	6½	S'thwk & V'xhall, 10 p. c. max.	100	164—169	..	3 16 11
126,500	100	,,	6½	Do. 7½ p. c. do.	100	160—165	..	3 18 9
1,155,066	Stck.	11 June	10	West Middlesex	100	251—256	+1	3 18 1

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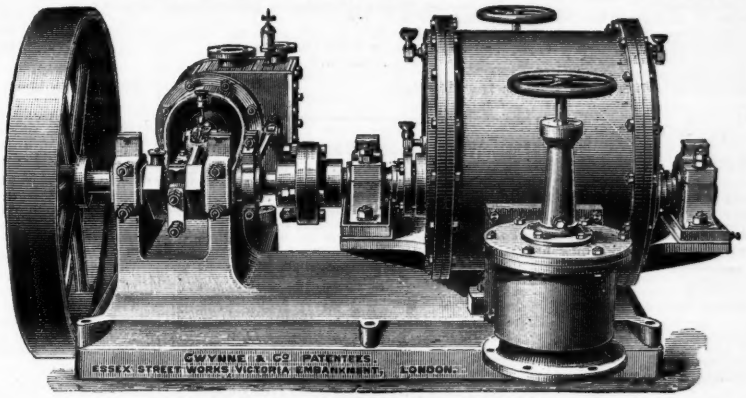

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Applications must be sent in not later than Monday, the 31st inst., and endorsed "Secretary."
ANDREW HAIR,
Secretary and Manager.
Pontypool Gas and Water Offices,
Aug. 17, 1891.

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FOR SALE—A Square Ornamental STATION METER complete. Capacity 8000 cubic feet per hour. The Meter is in good condition, and is being removed to make room for a larger one.
Apply to J. B. BALL, C.E., Gas-Works, LOUGHBOROUGH.
Aug. 19, 1891.

THE Clevedon Gas Company invite TENDERS for the AMMONIACAL LIQUOR to be produced at their Works during the next Six months.
Coal carbonized about 2500 tons per annum.
Sealed tenders to be sent to me on or before the 31st day of August next.
SAMUEL DAWES.
Gas-Works, Clevedon,
Aug. 21, 1891.

MILFORD IMPROVEMENT ACT, 1857.

TENDER FOR GAS COAL.

THE Milford Improvement Commissioners are prepared to receive TENDERS for about 600 tons of large through and small GAS COAL, to be delivered between the 29th of September, 1891, and the 29th of September, 1892. The whole of the Coal to be fresh hewn, clean, and free from impurities.

Further particulars and forms of tender can be obtained on application to the undersigned.

Sealed tenders, endorsed "Tender for Coal," addressed to the Chairman, Gas and Water Committee, to be sent in not later than the 19th of September next.

The Board do not bind themselves to accept the lowest or any tender.

By order,
THOMAS H. LEWIS,
Clerk.

Milford Haven,
Aug. 21, 1891.

TO TAR DISTILLERS AND MANUFACTURING CHEMISTS.

THE Windsor Royal Gaslight Company are prepared to receive TENDERS for the purchase of their surplus COAL TAR and AMMONIACAL LIQUOR (10-oz. Liquor) for One year, from Sept. 30, 1891.

The Tar will have to be removed in barrels; but the Liquor can be pumped into railway tanks on the Great Western Railway.

The Contractor must be prepared to keep the Company cleared of both Tar and Liquor, and to provide all the necessary barrels for the purpose.

The Directors do not bind themselves to accept the highest or any tender.

Any further information may be obtained on application to Mr. J. Wadeson, Manager.

Sealed tenders, stating price at the Company's Works free of all charges, must be sent in by Twelve o'clock at Noon on Tuesday, the 1st day of September, 1891.

By order,
JOHN HENRY STRANGE,
Secretary.

Gas Offices, Victoria Street, Windsor.

TO TAR DISTILLERS, ETC.

THE Directors of the Sheffield United Gaslight Company are prepared to receive TENDERS for the purchase of the surplus TAR made at their Neepsend and Effingham Street Works for the period of Twelve months, ending Aug. 31, 1892.

The quantities will be, approximately: Neepsend, 7050 tons; Effingham Street, 1500 tons.

At Neepsend the Tar will be loaded into tanks on the Company's Siding, on the Manchester, Sheffield, and Lincolnshire Railway, or into Barrel-Carts on the Works, and at Effingham Street, into Barrel-Carts only.

Forms of tender and conditions of contract may be obtained from the undersigned, to whom tenders, endorsed "Tender for Tar," must be delivered on or before Wednesday, Sept. 2.

The Directors do not bind themselves to accept th highest or any tender.

HANBURY THOMAS,
General Manager

Commercial Street, Sheffield,
Aug. 7, 1891.

HARTLEPOOL GAS AND WATER COMPANY.

TO GASHOLDER MAKERS.

THE Directors of the above Company are prepared to receive TENDERS for the several Works and Materials required in the construction and erection of a GASHOLDER, 150 feet in diameter and 30 feet deep, together with STANDARDS, GIRDERS, TIE RODS, &c., connected therewith, and the fitting and completion of the same at their Works at West Hartlepool.

Plans and specification may be seen, or any further information obtained, on application to the Company's Engineer, Mr. Thomas Bower, who, if desired, will supply copies of the plans and specification.

Tenders, on form prescribed, sealed, and endorsed "Tender for Gasholder," to be sent to Mr. Thomas Trewhitt, Secretary, Gas and Water Company, West Hartlepool, not later than Wednesday, the 2nd day of September next.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
THOMAS TREWHITT,
Secretary.

Gas and Water Company's Offices,
West Hartlepool, Aug. 1, 1891.

THE Corporation of Middleton are prepared to receive TENDERS for the supply of 3000 tons of GAS COAL and 1500 tons of CANNEL, delivered at the Middleton Railway Station (carriage free), in such quantities and at such times as the Corporation, or their Gas Manager, may require.

Sealed tenders, addressed to the Chairman of the Gas Committee, to be delivered at my Office on or before Wednesday, the 2nd of September, 1891, endorsed "Tender for Coal" or "Cannel."

Further particulars may be obtained by written application only to Mr. Duxbury, Gas Manager.

FREDERICK ENTWISTLE,
Town Clerk.

Town Hall, Middleton,
Aug. 21, 1891.

GAS TAR.

THE Widnes Local Board invite Tenders for the purchase of about 650 tons of GAS TAR from their Gas-Works for the Twelve months ending Sept. 30, 1892.

Form of tender and conditions of contract may be obtained from Mr. Carr, Gas-Works, Widnes.

Tenders, endorsed "Tar," to be delivered to the undersigned, not later than the 29th inst.

The Board do not bind themselves to accept the highest or any tender.

H. S. OPPENHEIM,
Clerk.

Town Hall, Widnes,
Aug. 12, 1891.

COUNTY BOROUGH OF WIGAN.

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee of the Wigan Corporation invite TENDERS for TAR for One year, commencing on the 1st of September, 1891, and terminating on the 31st of August, 1892.

Particulars and forms of tender may be obtained on application to the undersigned.

The highest tender not necessarily accepted.

Tenders, sealed, and endorsed "Tar," to be addressed and delivered to Arthur Smith, Esq., Town Clerk, on or before the 14th of September next ensuing.

JOS. TIMMINS,
Engineer, &c.

Borough Gas-Works, Wigan,
Aug. 21, 1891.

Price: 10*s.* *per* 100; £1 2*s.* 6*d.* *for* 250; £2 *for* 500; £3 15*s.* *per* 1000. *Specimen copy (by post)*, 4*d.*

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BROMLEY GAS CONSUMERS' COMPANY.

NOTICE is hereby given, that the ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the "Bell Hotel," Bromley, Kent, on Thursday, the 27th day of August inst., at Six o'clock precisely, to receive the Report of the Directors, the Balance-Sheet confirmed by the Auditors, to declare Dividends, and for General Business.

The Transfer Books will be closed from the 14th to the 27th of August, 1891, both days inclusive.

By order of the Board,
HENRY W. AMOS,
Secretary.

Offices at the Works, Bromley,
Kent, Aug. 12, 1891.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is hereby given, that the ANNUAL ORDINARY GENERAL MEETING of the Proprietors in this Company will be held at the Offices, Willoughby Lane, Tottenham, on Saturday, the 29th day of August inst., at Three o'clock in the afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended the 30th of June last, to declare Dividend, for the election of two Directors and an Auditor for the ensuing year, and for General Business.

The Transfer Books for Consolidated Stocks will be closed from the 14th to the 31st of August inst., both days inclusive.

By order of the Board,
JAMES RANDALL,
Secretary.

Offices of the Company:
Willoughby Lane, Tottenham,
Aug. 14, 1891.

MR. W. H. BENNETT having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their Inventions may be secured for Twelve months; or LETTERS PATENT, which are granted for Fourteen Years.

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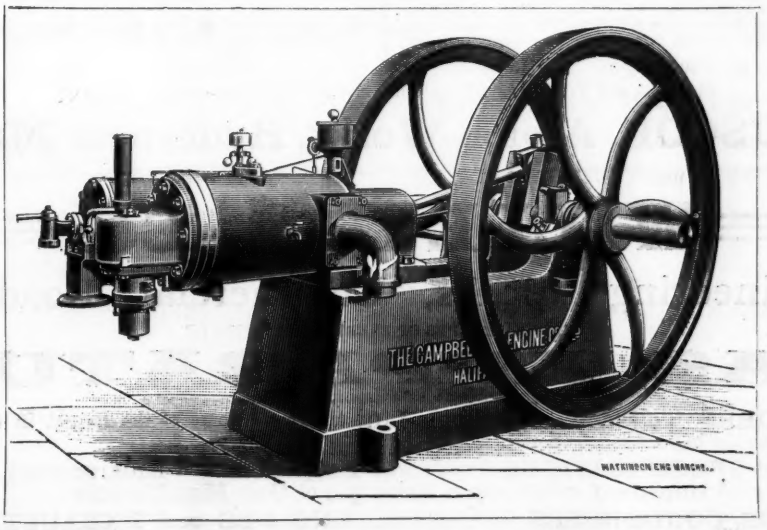

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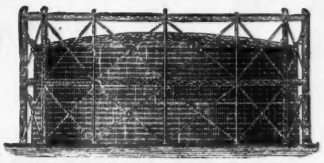

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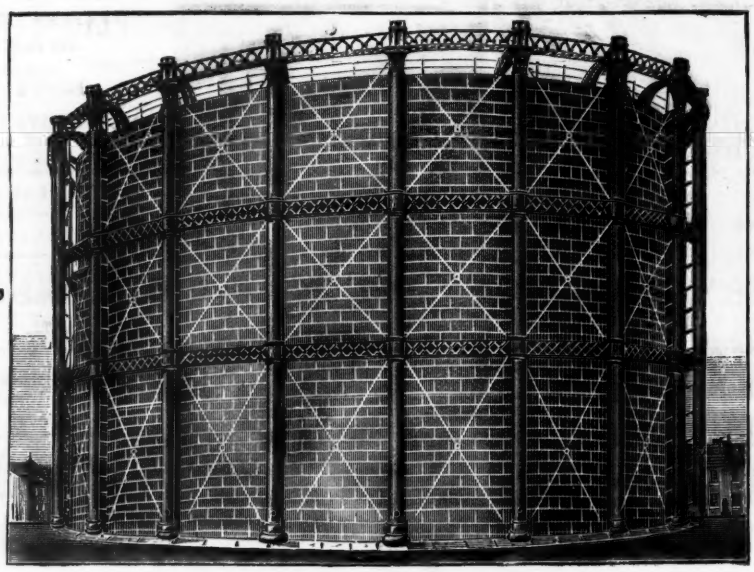

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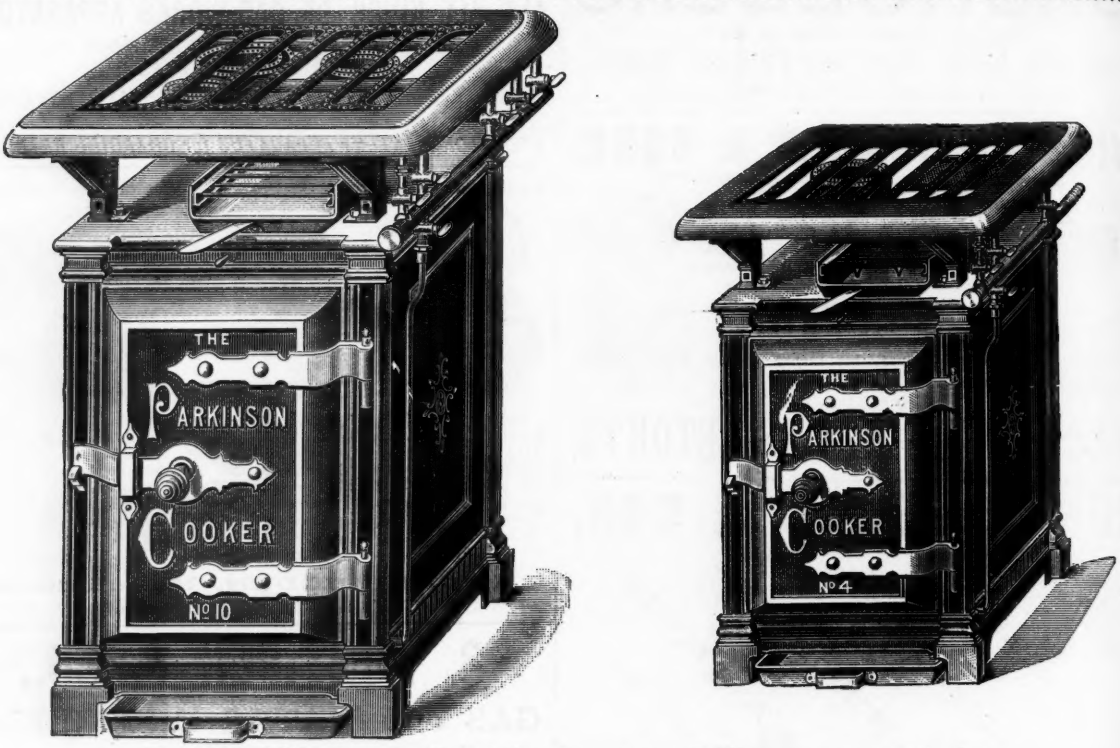

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Case of strong cast iron, packed with silicate to retain the heat. Most substantially made and very durable.

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New Double Grill, providing **two large square surfaces of great heat,** either of which will cook chops and steaks, &c., or toast bread to perfection. The Grill Burners can be used simultaneously for boiling **without any adaption or alteration.**

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[See also Advt., p. 342.

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